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FOUNDRY TRADE JOURNAL

AND PATTERN-MAKER.

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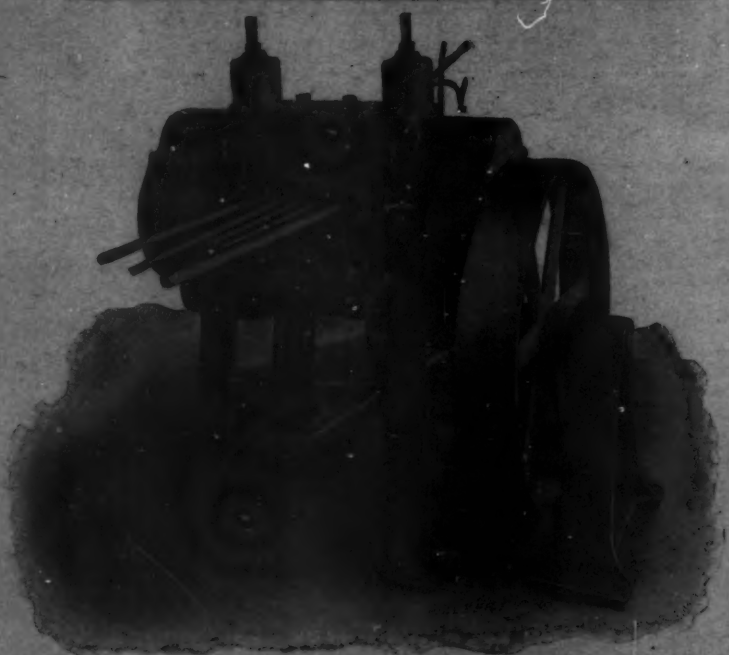

This illustration shows the Rods emerging from the machine a straightened and ready for use again.

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The Foundry Trade Journal

AND

PATTERN-MAKER.

Vol. 7. JANUARY 5, 1905. No. 37.

PUBLISHED MONTHLY BY
THE FOUNDRY PUBLISHING CO.

Devoted to the interest and advancement of the Iron, Steel and Brass Foundry Trades.

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We invite practical articles on the trade in all its branches, which will be paid for. *MSS. should be written on one side of the paper only.*

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THE BRITISH FOUNDRYMENS' ASSOCIATION.

We have pleasure in announcing that the Council of the British Foundrymens' Association have passed a resolution to notify their members that "The Foundry Trade Journal," be recognized the official organ of the Association. We need only say that this resolution is especially gratifying to the Editors of this Journal as being some indication that their efforts to produce a Magazine which shall cover the Foundry and Pattern Shop in all their attributes is receiving recognition. In these columns from month to month will be printed all information relative to the proceedings of the Association.

THE BRITISH FOUNDRYMENS' ASSOCIATION.

The President, Mr. Robert Buchanan, will lecture on "The Principles and Practice of Coremaking." at the Meeting of the Metallurgical Society, on Saturday, Jan. 14, 1905, at 7 p.m., at the Municipal Technical School, Suffolk Street, Birmingham. All Members are cordially invited to attend.

F. W. FINCH,
Hon. Secretary,
Kingston House,
Landsdown Road,
Gloucester.

CASTING LINERS AND VALVES

(By Anti-Friction.)

There are many kinds of liners, and the treatment for each kind differ, sometimes very materially.

Let us take for our first example liners cast on to tail shafts. These are generally cast where the bearings are placed, though to make a more excellent job, far more of the shaft should be covered, but in covering any part with a liner much care should be exercised. If a brass liner is to be cast on to the tail shaft, where possible the author would always endeavour to cast these at two operations. Thus, if the liner is to be 1 in. in thickness, cast ½ in. on first, then finish the other ½ in. Though this is making two operations, it will be found in the majority of cases to be the cheapest in the long run, and the finish of the liner thus made can always be assured, seeing it is "brass on brass," whereas in the first coat, when the metal is cast on to a steel shaft, the resulting liner is generally a very poor specimen, full of blow holes, the shaft causing a spongy casting, which is overcome by producing the liner at two operations, and allowing the necessary vents, also risers for feeding.

White Metal Liners.

Some of these are cast and placed in position, and others are cast as so many strips, so as to be driven into the bearings, the bearings in the first place having been cast, with dovetailed apertures, to admit them. After they are driven into place, the bearing surfaces are turned to admit of the finished diameter of the journal. The metal for this should be a white brass and not bronze, a stiff alloy such as the following being good:—Copper, 5 parts; tin, 26 parts; spelter, 69 parts.

Referring to the trouble that occurred in the making of a liner, referred to in the columns of this journal a short time ago, from the description given the liner evidently was cast flat or horizontal. If such was the case it was not by any means the best way, the better method being to cast it vertically or nearly so. Coke could hardly have been said to have caused the failure, but more probably the metal was cast hot, and the dross or zinc oxide caused by the heat of the metal entered the mould and caused the holes in the "liner." The question arises, was the mould dried. If not, and the casting was of any fair weight, then the sponginess might easily have been caused by steam

generated in the green sand mould that was unable to escape before the metal solidified. In this case the part of liner that would be spongy would be contained in the top or cope side of the mould.

Bronze Locomotive Valves.

I will next, for a brief moment or two, touch upon the question of casting such work in "bronze" as locomotive valves. Of course each railway or engineering company has its own particular designs, but as they are all for one purpose, they are, in essential particulars, the same. As in pattern, so in the "alloys" of bronze, each company has its own mixture, and vie with each other to produce a valve that shall stand the largest amount of wear before being consigned to the scrap heap.

The valve should stand any pressure of steam without disclosing defects, otherwise it is useless, seeing that the escape of steam through any defect would so seriously affect the efficiency.

For casting such valves the cavity underneath, whether produced by a green or dry sand core, can make little difference, but the point to be taken into consideration is the question of contraction, owing to the hardness of the bronze. The making up of the mould presents no more difficulty than any ordinary engineering casting, excepting that it is far best to have a double gate from the runner, and the latter being of good diameter, it is seldom that risers are called for. This method will ensure a better casting than is often the case with one corner runner, this latter being, to my mind, a very unsatisfactory way of casting them. When the cast has been made, as soon as possible turn over the mould and take off the drag, and carefully get out the core or loosen same. This being done, the valve will be able to contract, without let or hindrance. There will be fewer rejections, as the metal will solidify, without cracking, as it meets with no opposition, when the core is loosened or cleared out after being cast.

MR. W. BARDILL, who resigned his position as manager of Heenan & Froude, Limited, of Worcester, he having acquired an interest in the works of the Wantage Engineering Company, Limited, of Wantage, Berkshire, has now taken over the control of these works, which are chiefly owned by the trustees of the late Lord Wantage, and have been established over 65 years. We understand that the firm intend to considerably develop the manufacture of mining machinery in the near future.

MOULDING A GROOVED CRANE BARREL WITHOUT A PATTERN.

BY R. D. WELFORD.

BY adopting the method here described crane barrels of various sizes can be moulded without the expense of providing a pattern. After the tackle has been provided the only requirements will be the provision of two boards for each barrel, and the actual time occupied in moulding will not exceed the time usually occupied in moulding from a full pattern in green sand, with the advantage of obtaining a better and sounder casting.

The first thing required for the job is a box, which, as it will have to be a special one, will have to be considered in some little detail. The best and most useful type of box will be of the frame

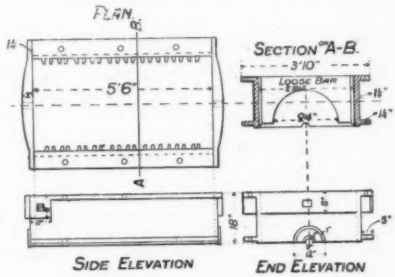


FIG. 1

type, with loose bars which can be removed and others inserted to better suit the particular barrel to be moulded. It will also have to be provided with facing pieces on either end to serve a purpose which will be described later. The sketch of box, as shown in Fig. 1, will almost explain itself, and will be found a very useful size. Both halves are made exactly alike. Holes are shown in the ends for loose trunnions, or fast ones can be cast either on or in. Holes are also shown for loose trunnions for the purpose of turning the box upon its end for casting if required.

Provision is also made for bolting plates on if thought necessary by means of holes in the flanges. If rammed up in a hole about 4 ft. deep plates are not required. Facing pieces, as shown, must be cast on each end, and a hole left in one part for running purposes. When cast the joints are planed, and box parts fastened together. Holes are now bored in the lugs and pins fitted. The facing pieces at the ends are planed, and a 2-in. hole

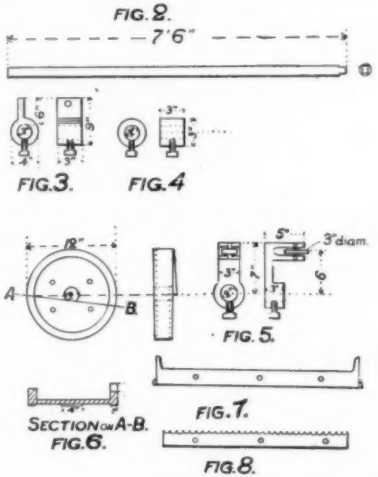
bored exactly in the centre of the joint so that the hole in each half of the box is equal.

The next step will be the provision of suitable appliances for sweeping purposes. A bar 7 ft. 6 in. long, 2 in. diameter, and perfectly round, with one end made square for a handle to fit, will be required (Fig. 2), also three arms (Fig. 3) provided with set screws, and made a good fit on the spindle. Two stop pieces, as shown at Fig. 4, will also be required, and an arm, Fig. 5, provided with a small wheel, in order that it may run on the guides. Next is required a right and left-hand guide for the pitch of the groove. These must be made with facing pieces on the backs similar to those on the box ends, and a pitch guide piece on the front (see Fig. 6). These can be made off a whole pattern, and split or cast in halves. When pitch guides are cast the facing pieces are planed or filed, and they are placed in position on box ends with the half hole in centre, fitting the half hole in box part. Holes are then bored through, and set screws provided for fixing them in place. The next item for consideration will be the sweeping boards, of which two are required, one a plain board to sweep the barrel (Fig. 7), and another to sweep the grooves (Fig. 8), with holes as shown for fastening purposes, for which small bolts can be used. Having provided all the tackle the actual work of moulding can now be commenced. Loose bars having been cast to suit the diameter of the barrel, they are wedged in, keeping wedges below the box edges. The box parts are now turned over and laid down on their back side by side. Sand is now rammed in level with the joints, and strickled off level with a straight edge. Now the board (Fig. 7) is fastened to the spindle by means of the small arms (Fig. 3) and the spindle placed in the box; fix the stop collars (Fig. 4) in position on the spindle, outside of the box, and touching the small facing pieces. These pieces will ensure the mould joining accurately when put together.

Now cut the sand away so that the board clears about ¾ in., and wet the face of the sand with thin clay water, and strike up, or rather rough up, in the usual manner with loam. Then transfer the spindle and board to the other half of the box and repeat the process. A light board to place on the joint while sweeping will be an advantage.

The moulds are now plain barrels and can be left to stiffen overnight or stoved as desired. Next morning replace the spindle in the box, and fix the board (Fig. 8) to the spindle, placing the end groove in position near the end of barrel. Fix the guide with the wheel attached (Fig. 5) securely to the spindle, and touching the outermost edge of the pitch guide level with the box edge.

Now sweep up the grooves, taking care that the wheel of the arm is kept close up to the pitch guide. Start from the point where the board was set, and as the board is moved round by means of the handle on the spindle, the grooves will follow the guide on the box ends, and will, in the half box, gain half of the pitch. If for a right and left groove the board will only require to be half the length, and is swept in the same manner as a full length board.



The spindle is then moved to the other half box, and the process is repeated. In the case of the right and left-hand groove the pitch guides are now placed on the other end of the box parts, and the other half of the grooves swept.

The mould is now complete except for runners, which can be cut out of the joint and made either to cast on end or on the flat, as preferred. The mould is now dried and blacked off, the core being made and inserted in the usual manner, care being taken to fasten it well down by means of a small bolt if the job is to be cast on end. The resultant casting should be good, sound, and accurate, requiring nothing more than the attention of the fettler before the ropes or chains are attached to it.

—o—

James Nelson & Son, Alma Boiler Works, Gallowgate, Glasgow, has been registered as a limited company.

CASTING STEEL WHEELS FOR PIT TUBS.

THE preparation of moulds for casting tub-wheels is an exceedingly simple operation. As shown at *a*, Fig. 1, the pattern is accurately made in one piece, with a metal

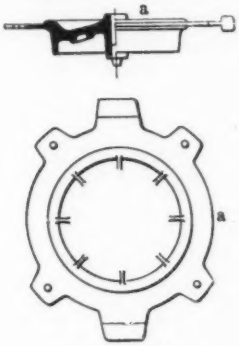


FIG. 1.

pattern plate, the two portions of the wheel being on opposite sides of the plate. The two mould-boxes, *b* and *c* (Fig. 2), are cylinders of sheet metal, which are springy, and are tightened up with thumb-

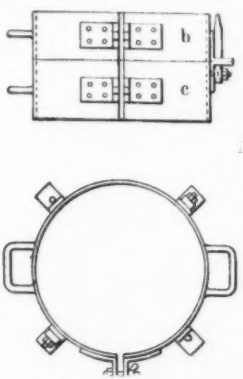


FIG. 2.

screws. Both the top half, *b*, and the bottom half, *c*, of this box carry a couple of projecting spikes, which serve to guide the pattern plate, and are of such a length that the pattern cannot get out of place in being withdrawn from the sand. Consequently, the sand does not collapse, and there is no need to repair any defects from this cause afterwards.

Figs. 3 and 4 illustrate the manner in which the mould is prepared. As soon as they have been properly rammed, the lower box is taken away first, and is laid

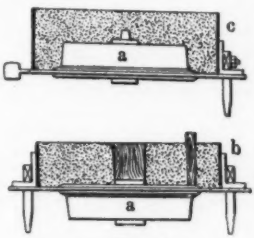


FIG. 3.

on a bed of sand, whereupon the pattern is withdrawn from the upper box, which is then placed on the lower box. On loosening the screws, the elasticity of the box walls causes them to separate from the sand mould, so that the box can be taken away easily. A number of the finished moulds are laid, side by side, on the bed of sand (Fig. 5), and the intermediate spaces between them are filled with rammed sand. To prevent the pouring gates and vents in the moulds admitting

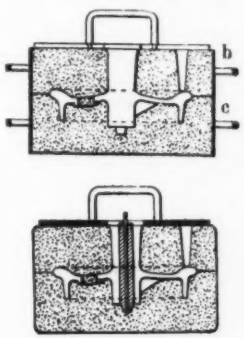


FIG. 4.

any sand during this operation, they are covered with a metal plate. The ramming of the sand fixes the upper and lower parts of the moulds firmly together, and renders weighting unnecessary. The cores for the axle bushes are put in shortly before casting. Two men can prepare 60-80 moulds in a 10-hours' shift. All sizes of tub-wheels, up to 20 in. diameter and 1 cwt., are cast in green sand.

Hitherto, the bulk of the steel used for these purposes has been produced in crucible, or in open-hearth furnaces, the

former being expensive and, indeed, unprofitable, except for better grades of steel, whilst the open-hearth process necessitates a large output if it is to be at all economical. These considerations, in conjunction with the difficulties in the way of turning out really good and reliable steel castings, have, up to the present, kept this class of work entirely in the hands of large and well-equipped works. Lately, a small Bessemer plant, of the Schmidt-Zenzes type, constructed by Fr. Gebauer, of Berlin, and illustrated in Fig. 6, has been brought out, by the use of which it is claimed to be possible to produce steel castings in small quantities with the converter, so that any iron-founder can enter the lists as a competitor

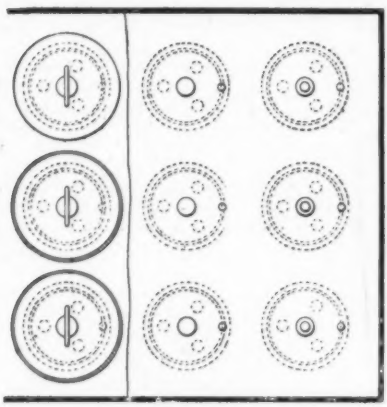


FIG. 5.

in this trade, and engineers, even, can make their own castings. At the same time, this plant forms a useful accessory in large open-hearth steel works, since, on account of its adaptability, it may serve to either supplement the output of the large plant, or replace the latter when orders are slack. For a production of 10-15 tons per diem, the plant consists of two converters and two cupola furnaces, together with the needful accessories.

The special advantages claimed by the makers of this plant are that it has a large producing capacity in comparison with the cost of the installation, can be easily adapted to any existing foundry plant, is easy to manage and needs but little attention, has a low percentage of waste, the blow is completed in a very short time, so that several charges can be collected and used together when large castings are required, and it furnishes an excellent steel.

FAN AND POSITIVE PRESSURE BLOWER TESTS.*

IN a recent paper by Mr. Thos. D. West, entitled "Fan Power for the Cupola." Mr. West gave his experience in installing a fan for cupola work. He included data which showed that it required a very much greater horse-power to run the fan than had been anticipated by the makers. He called attention to the fact that the data supplied by the fan builders made no mention of the horse-power required, and contended that some data should be compiled showing the power used in running a fan with an open and closed outlet. This paper brought out a very spirited discussion regarding amount of horse-power required to run a fan blower and a positive pressure blower.

A committee was appointed, as a result of this discussion, to investigate this question further. They sent out a list of questions to representative foundries, hoping that the answers would determine approximately what horse-power was being used to run a fan and a positive pressure blower. Interesting answers were received to these questions. Very few of them were complete, however, and it was impossible to obtain from them the information desired. These replies were tabulated and presented to the Association at a subsequent meeting. The contradictory results reported in these answers were very unsatisfactory to the committee, and Mr. W. H. McFadden, a member of the committee, volunteered to have a test made at the works of Mackintosh, Hemphill & Company. He contended that, in order to get a true comparison, tests should be made under exactly the same conditions. Inquiries were sent out to different fan and blower makers for fans and blowers to be used in the test. The Connersville Blower Company, Connersville, U.S.A., and the B. F. Sturtevant Company, Hyde Park, Mass., very kindly agreed to supply a positive pressure blower and a fan blower, respectively, for the test.

Construction.

The size of the cupola, together with other necessary data, was supplied to each, and the selecting of the blowers, pulleys, etc., was left to them. They were asked to have their representative present at the test, and both sent their mechanical engineer. The capacity, speed of motor,

* Read before the Pittsburg Foundrymen's Association. The tons used in this paper are tons of 2,000 lbs.

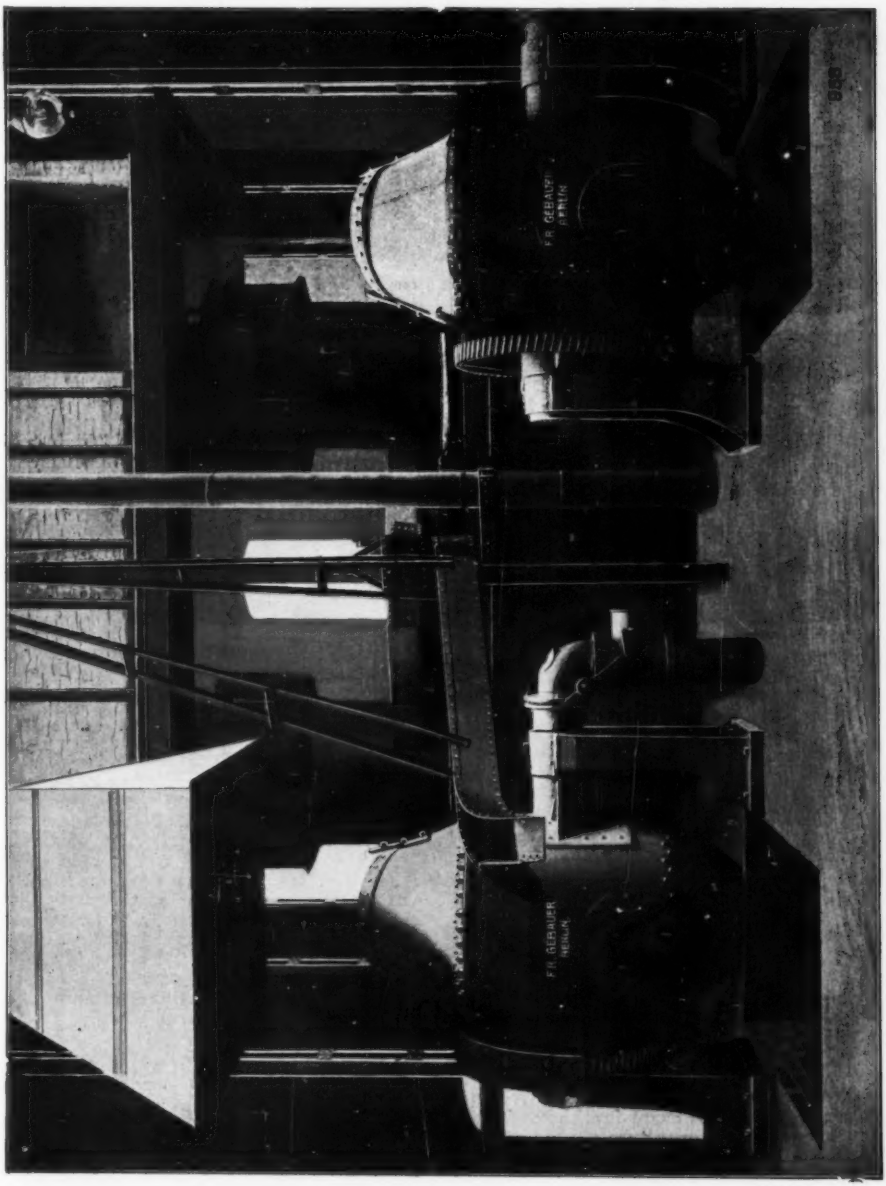


FIG. 6.—SMALL STEEL CASTING PLANT USING BESSEMER PROCESS.

sizes of pulleys, position of blowers and fans, and the arrangement of the piping was satisfactory to the representatives of the fan and blower makers.

The 33 cubic feet positive pressure blower was placed on a solid cement foundation at a considerable expense. The No. 10 fan was placed on a heavy oak platform directly over the blower. They were so arranged in order to save room and piping and to eliminate one bend in the pipe for fan connecting. It was necessary to have one extra elbow in the blower connection. The pipes enter the cupola at the top of the wind box on opposite sides of the cupola. The pipe was No. 10 riveted, and was guaranteed air tight by the makers. A water column pressure gauge was used for taking pressure, and was attached to the wind box of the cupola.

Speed of Motors and Blowers.

The same motor was used for both tests (a 50 h.p., 220 volt, shunt-wound, rated at 825 r.p.m.). For the blower test, it was run at an average speed of 819 r.p.m., and for the fan test at a speed of 839 r.p.m. For the fan test the motor was equipped with a 30-in. pulley, and the fan was fitted with a 16-in. diameter, 15-in. face pulley. The Sturtevant Company had previously notified us that they desired to run the fan at from 1,500 to 1,550 revolutions. The blower was equipped with a 60-in. pulley, 15-in. face, and the motor was fitted with a 12½-in. pulley.

First Test—October 17.

In the first test the blast was supplied by the No. 10 Sturtevant fan.

Sixty thousand seven hundred (60,700) lbs. of metal were charged into the cupola. One-half scrap and one-half pig was used, as being a fair representative of ordinary foundry practice. Fifteen hundred (1,500) lbs. of coke were charged on bed, followed by 4,500 lbs. of iron. The balance of the heat was made up of 4,000-lb. charges, with 450 lbs. of coke to the charge. The last charge was 4,200 lbs. of iron.

Readings were taken every ten minutes, the pressure at the cupola being taken at the same instant as were the readings at the motor. Table No. 1 gives a condensed record of this heat.

This shows the time readings were taken, the pressure at the cupola, the temperature of the metal, the current and voltage readings, the electric horse-power figured from the latter, and the horse-power figured from the curve furnished with the motor. The temperature of the metal was taken in order to determine whether there was any decided difference in temperature of the iron melted with the fan and blower. The material charged, including coke, was all accurately weighed. The melted iron was weighed as it came from the cupola,

Table No. 1.

Time.	Pressure.	Number volts.	Number amperes.	Electric horse-power.	Horse-power.	Speed.	Temperature.
2.02	12½	212	145	41.2	36	840	.....
2.10	12½	208	155	43.2	38.5	844	.....
2.20	12¾	215	148	42.6	38	840	.....
2.30	12¾	216	144	41.7	37	845	.....
2.40	13¼	216	132	38.2	33.5	850	.....
2.50	13½	220	128	37.7	32.5	840	.....
3.00	13¾	218	130	38	33	840	.....
3.10	13	218	128	37.4	32.5	825	.....
3.20	13¾	218	120	35.1	30.5	840	.....
3.26	....	...	....	....	....	...	.....
3.30	13½	220	126	37.2	32.5	845	2,185° (ladle)
3.40	13¾	216	125	36.2	31.5	830	.....
3.50	13¾	220	115	33.9	30	845	.....
4.00	14	217	122	35.8	31	847	.....
4.10	14	217	112	32.6	28	845	.....
4.20	14	219	112	32.9	28.5	837	.....
4.30	14½	217	110	32	27.5	840	.....
4.40	13¾	217	105	30.5	25	832	2,150° (ladle)
4.50	13¾	214	105	30.1	25	832	.....
5.00	13¾	214	110	31.5	29	830	.....
5.10	13¾	218	110	32.1	27.5	838	.....
5.20	14	219	110	32.3	28	838	.....
5.30	14	220	115	33.9	30	840	.....
5.40	13¾	220	120	35.4	31	840	.....
5.50	13¾	219	130	38.2	33.5	837	.....
Average.	13.6	...	...	35.8	31.2	839	.....

and is recorded in Table No. 2, which gives a record of the iron melted as each ladle was taken from the cupola:—

TABLE No. 2.

	Time.	Time taken. Hr. min.	Amount melted. lbs.
Wind on	2.02		
First tap	2.23	0 21	
First ladle out	3.38	1 15	27,630
Second ladle out	4.39	1 1	14,750
Third ladle out	5.10	0 31	6,000
Fourth ladle out (bottom drop)	5.48	0 38	7,800
Amount taken out in shanks			700
Amount left in cupola ...			800
Total amount melted iron			57,680

Figuring from the above data, we find that the heat lasted 3 hr. 46 min. The average amount of iron melted per hour, based on iron melted, was 15,312 lbs., or 7.65 tons. During the first part of the heat, the cupola melted at the rate of 17,200 lbs. per hour. In the middle of the heat, it was melting at the rate of about 15,000 lbs. per hour, while at the end of the heat it was melting but 12,200 lbs. per hour. This decrease in the rate of melting was due to the fact that the tuyeres became partly closed up at the end of the heat; consequently, less wind was supplied by the fan. These data are included in Table No. 3.

TABLE No. 3.

Total time of heat	3 hr. 46 min.
Average melted per hr. based on iron charged	16,116 lbs. (8.06 T)
Average melted per hr. based on iron melted	15,312 lbs. (7.65 T)
Rate of melting, first of heat ...	17,262 lbs. (8.63 T)
.. .. middle of heat...	15,000 lbs. (7.5 T)
.. .. end of heat ...	12,230 lbs. (6.12 T)

From Table No. 1 we find that the average electric horse-power consumed would be approximately 35.8. The heat lasted 3.76 hours, so that the total e.h.p. consumed was about 134.8. The amount charged was 30.35 tons. The e.h.p. hours per ton charged would consequently be 4.41 and the k.w. hours per ton charged would be 3.29. From these data, with the cost per k.w.h. known, the exact cost of power for the heat can be figured:—

TABLE No. 4.

Total length of heat	3 hr. 46 min.
Average horse-power consumed by motor	35.8
Total e.h.p. hours for heat	134.8
Tons charged...	30.45
E.h.p. hours per ton charged	4.41
K.w. hours per ton charged	3.29
Tons melted	28.84
E.h.p. hours per ton melted iron ...	4.67
K.w. hours per ton melted iron ...	3.41

Second Test—October 19.

In the second test, a 33 cubic feet Connersville blower was used to supply the blast. The conditions prevailing during this heat were the same as governed the test on the Sturtevant fan. The same motor was used; the proportion of pig-iron to scrap was identical; the cupola was charged in a like manner, and the scrap selected was of a similar grade to that used in the previous test. Sixty-three thousand lbs. (63,000) instead of 60,700 were melted. Fifteen hundred lbs. of coke were used on the bed and 4,500 lbs. of iron were charged on the first charge. There were 450 lbs. of coke and 4,000 lbs. of iron in the next fourteen charges. On the 16th charge, 300 lbs. of coke were used to 2,500 lbs. of iron. This proportion of coke to iron gave a ratio of about 1 to 8, which is a fair average of foundry practice.

Table No. 5 gives a record of the time the readings were taken, the current and voltage, the electric horse-power, figured from the same, and the horse-power figured from the curve sent with the motor. The speed of the motor and the pressure readings were taken at identically the same time as were the volt and ammeter readings.

Table No. 5.

Time.	Pressure.	Number volts.	Number amperes.	Electric horse-power.	Horse-power.	Speed.	Temperature.
2.00	10½	224	80	24	10	825	.....
2.10	14⅝	217	110	32	28	830	.....
2.20	14	216	108	31.4	26	830	.....
2.30	16½	218	118	34.5	30	835	.....
2.40	18½	218	130	38	32.5	835	.....
2.50	21⅜	216	150	43.4	39	830	.....
3.00	23¼	214	152	43.6	39	810	.....
3.10	23	215	152	43.8	39	810	.....
3.20	23½	212	152	43.2	38	810	.....
3.30	23½	214	155	44.4	40	812	2,165° (ladle) first
3.40	23	212	156	44.3	40	815	.....
3.50	24	216	160	46.3	41	815	.....
4.00	24	214	165	47.3	42.5	820	.....
4.10	25	210	177	49.8	45	815	2,175° (ladle) second
4.20	24½	212	170	48.8	43.5	816	.....
4.30	20⅝	214	145	41.6	36.5	830	.....
4.40	19¾	214	140	40.2	35	830	.....
4.50	19¼	218	123	35.4	30.5	780	.....
Average.	20⅝	...	...	40.6	35.8	819	.....

Table No. 6 gives a record of the iron as melted:—

TABLE No. 6.

	Time.	Time taken. Hr. min.	Amount melted. lbs.
Wind on	2.00		
First ladle out	3.33	1 33	31,800
Second ladle out	4.05	0 32	12,100
Third ladle out	4.28	0 23	6,620
Fourth ladle out (bottom drop)	4.49	0 21	6,950
Taken out in shanks, left in cupola, etc.			2,207
Total amount melted iron			59,677

The total time consumed was, therefore, 2 hr. 49 min. The average melting per hour figured on the amount charged was 22,368 lbs. (11.2 tons). The average per hour figured on the amount melted iron was 10.6 tons. During the first of the heat the iron was melted at a rate of 20,500 lbs. per hour; during the middle of the heat, at the rate of 22,400 lbs. per hour; during the last of the heat, at the rate of 17,700 lbs. per hour. These data are included in Table No. 7:—

TABLE No. 7.

Total time of heat	2 hr. 49 min.
Average melted per hr. based on iron charged...	22,368 lbs. (11.2 T)
Average melted per hr. based on iron melted	21,186 lbs. (10.6 T)
Rate of melting, first part of heat	20,520 lbs. (10.2 T)
" " middle of heat ...	21,400 lbs. (10.7 T)
" " last of heat ...	17,718 lbs. (8.9 T)

From Table 5 we find that the e.h.p. taken by the motor was 40.0. The heat lasted 2 hr. 49 min., consequently the total e.h.p. consumed was 114.49 h.p.h. 31.5 tons were charged, so the e.h.p. per ton charged would be 3.63 and the k.w.h. per ton charged would be 2.71. These data are included in Table 8:—

TABLE No. 8.

Average e.h.p. supplied to motor	40.6
Total e.h.p. hours for heat...	114.49
Number of tons charged	31.5
E.h.p. hours per ton charged	3.63
K.w. hours per ton charged	2.71
Number tons melted iron	29.8
E.h.p. hours per ton melted iron	3.84
K w. hours per ton melted iron	2.86

In Table 9 are included data on both tests.

Comparisons.

If we examine this table, we will note that in the two tests which we will call official, the average e.h.p. for the fan was 35.8, while the average for the blower was 40.6. The highest h.p. required by the fan was 43.2 against 48.3 for the

blower. If, however, we note the total horse-power consumed, we will see that the fan consumed 134.8 h.p.h. for 30.35 tons, while the blower required but 114.49 h.p.h. for 31.5 tons. This shows 4.41 h.p.h. per ton of iron charged for the fan and 3.63 h.p.h. per ton of iron charged for the blower; a difference of .78 h.p.h. in favour of the blower. The difference

Table No. 9.

	Oct. 17. Sturtevant.	Oct. 19. Connersville.	Oct. 22. Connersville.	Nov. 16. Sturtevant.
Tons charged	30.35	31.5	32.	31.
Tons melted	28.84	29.5	30.06	28.81
Tons iron charged per hour	8.06	11.2	10.9	10.07
Tons iron melted per hour	7.65	10.6	10.2	9.40
Number of hours run	3.77	2.82	2.93	3.08
Average electric horse-power (motor)	35.8	40.6	36.3	34.6
Average horse-power (from curve)	31.2	35.8	31.55	....
Horse-power hour per ton charged	4.41	3.63	3.32	3.43
Kilowatt hour per ton charged.	3.29	2.71	2.47	2.68
Horse-power hour per ton melted	4.67	3.84	3.53	3.70
Kilowatt hour per ton melted..	3.41	2.867	2.63	2.76
Average speed of motor in revolutions per minute	839	819	756	1102
Average speed of blower in revolutions per minute	1557	171	151	2204
Average pressure in ounces	13.6	20.6	20.75	12.5
Ratio of coke to iron	1-7.82	1-7.78	1-7.9	1-8

in time of melting the two heats was 57 minutes in favour of the blower. This would allow the user of the blower to postpone putting on the blast about one hour longer for a 30-ton heat. The saving thus made would depend upon the class of work and the number of men employed. Against these advantages in favour of the blower may be set the lower original cost of the fan, the lower cost of installation, and the fact that the high pressure of the blower test was much more severe on the lining of the cupola.

The fan blower makers claim a saving in repairs and in wear over the positive pressure blower, while the makers of the latter call attention to the great wear and slipping of the belts due to the high speed at which the fan runs. These are points that cannot be settled in a two days' test.

The results of these tests show:—

1. Under the conditions existing in the test, it took 4.8 less horse-power to run the fan than it did the blower.

2. That to melt a 30-ton heat, it took 23.4 less h.p.h. with the blower than with the fan.

3. That it took approximately one hour longer for a 30-ton heat when the fan was used than when the positive pressure blower supplied the blast.

4. That the temperature of the metal was approximately the same for the two heats.

5. That the blower caused a much greater wear on the lining of the cupola than did the fan.

Note.—In comparing these records with other tests, it should be remembered that very heavy scrap was used and the records obtained should not be compared with a cupola melting light scrap. This difference in the weight of the scrap makes a large difference in the speed of melting in a cupola, as will be shown in the latter part of this paper.

Supplementary Tests.

In examining the data obtained from the two previous heats, the author was convinced that the results obtained in the blower tests could be improved in economy by running the blower at a slower speed. To prove this, another heat was run. While this heat cannot be said to be official, the data should be of interest to this Association.

Third Test—October 22.

In a third test, the pulley on the motor was reduced to 12 in., and the motor was run at a speed of 756 revolutions, instead of 819 revolutions, as in the previous heat. The data for this test will be found in Table No. 10:—

Table No. 10.

Time.	Pressure.	Number volts.	Number amperes.	Electric horse power.	Horse power.	Speed.
12.15	11	225	80	24.1	20	760
12.25	11⅝	225	92	27.7	23.5	770
12.35	12½	225	76	22.9	17.5	770
12.45	15	225	90	27.1	23	765
12.55	16¼	220	100	29.5	26	765
1.05	19½	220	110	32.4	28	760
1.15	22½	210	125	35.2	30	745
1.25	23⅞	225	130	39.2	35	750
1.35	25¼	218	145	42.4	37.5	750
1.45	24⅝	210	145	40.8	35.5	750
1.55	25	214	140	40.2	35	750
2.05	25	218	145	42.4	37.5	750
2.15	25½	216	150	43.4	38.5	760
2.25	26	210	155	43.6	38.5	760
2.35	26	216	155	44.9	40	770
2.45	26	216	155	44.9	40	760
2.55	21⅛	220	130	38.3	34	770
3.05	20⅛	220	125	36.8	32	780
3.15	18⅝	220	113	33.3	29	780
Average	20⅝	218	124	36.3	31.55	756

It will be noted that average pressure was approximately the same as in the previous heat, but that the average e.h.p. was decreased from 40.6 on the 19th to 36.3 on the 22nd. To be sure, the time for the heat was slightly prolonged, but the total number of h.p.h. consumed was decreased from 114.49 to 106.36. The writer believes that a still further decrease in the amount of air supplied would have shown a greater economy in the e.h.p. consumed. The motor was run, however, at the slowest speed; the pulley on the motor was as small as it was possible to use, and it did not appear to be practical to use a larger pulley on the blower. It would have been necessary to instal a slower speed motor to carry the investigation any further. Under the conditions this was not practical. Further data in

connection with this heat will be found in Table 11:—

TABLE No. 11.

Wind on	12.14		
First tap...	12.38		
All melted (2 hr. 56 min.) ...	3.10	59,160	
Left in cupola		990	
Total amount melted ...		60,150	
Rate of melting per hour (iron charged)		21,816	(10.9 tons)
Rate of melting per hour (iron melted)		20,502	(10.2 tons)
Total e.h.p. hours		106.36	
E.h.p. hours per ton iron charged		3.32	
K.w. hours per ton iron charged		2.47	
E.h.p. hours per ton iron melted		3.53	
K.w. hours per ton iron melted		2.63	

For a comparison of this heat with the two previous heats see Table 9.

Fourth Test.

We observed in our regular heats that better results were obtained with our old No. 8 Sturtevant fan than was shown in the test with the No. 10 fan. In order to ascertain exact figures for comparison, a further supplementary heat was run November 16, using the No. 8 Sturtevant fan. This test cannot be used as a direct comparison with the others, as it was taken at a different time and the conditions necessarily varied. This fan had been used in our works for several years. The motor was a 30 h.p. Westinghouse motor, and was run at an average speed of 1,100 r.p.m. Piping was new and air-tight. There was one more bend in the pipe than when the No. 10 fan was tested. The readings were taken by our electrical engineer. Exactly the same conditions were observed as prevailed in the previous heats. One-half pig and one-half scrap was used in making up the charges. The

Table No. 12.

Time.	Pressure.	Number volts.	Number amperes.	Electric horse-power.	Speed.
1.45	11	218	115	33.6	1,100
1.55	10½	214	128	36.7	1,100
2.05	11¾	220	130	38.5	1,100
2.15	12½	220	130	38.3	1,100
2.25	12¾	220	128	37.2	1,100
2.35	12¾	220	125	36.8	1,100
2.45	12¾	220	125	36.8	1,100
2.55	12¾	218	120	35.1	1,100
3.05	12¾	220	115	33.9	1,100
3.15	13¼	220	115	33.9	1,120
3.25	13¾	220	115	33.9	1,100
3.35	12½	220	112	33	1,100
3.45	13¼	218	110	32.4	1,100
3.55	13¼	218	110	32.1	1,120
4.05	13¼	218	110	32.1	1,100
4.15	13¼	216	110	31.5	1,100
4.25	12¼	216	115	33.3	1,100
4.35	12¾	220	115	33.9	1,100
4.45	11¼	...	...	....	.....
Average....	12¼	...	...	34.6	1,102

same method of charging was observed and a ratio of one of coke to eight of iron was maintained. The chief difference between this heat and the three previous was in the scrap. In the three previous heats all the scrap used was heavy scrap in such shape as to pack closely in the cupola. In the last heat there was a small amount of very light scrap used, which tended to keep the cupola open. The result of this will be noted in the reading found in Table 12.

The material charged and the melted iron were weighed, as in previous heats. The temperature of the iron was not taken, but it came good and hot all through the heat. The record of this heat will be found in Table 13:

TABLE No. 13.

		lbs.	
Wind on	1.43		
First ladle out	2.30	12,360	
Second ladle out	3.00	10,600	
Third ladle out	3.22	7,150	
Fourth ladle out	3.47	7,720	
Fifth ladle out...	4.26	11,850	
Sixth ladle out...	4.48	6,790	
Taken out in shanks and left in cupola		1,160	
Total amount melted ...		57,630	(28.81 tons

It will be noted from the above that the cupola melted very uniformly throughout. The average melting per hour per ton charged was 10.07 tons, and the average melted iron tapped per hour was 9.41 tons. From 1.43 to 3.22 (1 hr. 39 min.), 30,110 lbs. were melted or a rate of 9.1 tons per hour for the first hour. In the middle of the heat, the iron was tapped at a rate of 9½ tons per hour, and, at the end of the heat, it was tapped at a rate of 9.3 tons per hour. This shows the uniform melting mentioned above. Table 14 gives the above data and Table 15 gives horse-power, etc., figured from two previous tables:—

TABLE No. 14.

Average melted per hr. based on iron melted	10.07	tons
Average melted per hr. based on iron charged	9.41	tons
Rate of melting, first of heat	9.1	tons hr.
,, middle of heat ...	9.5	tons hr.
, ,, last of heat	9.4	tons hr.

TABLE No. 15.

Average horse-power consumed by motor ...	34.6
Total e.h.p. hours for heat	106.56
H.p. hours per ton charged	3.43
K.w. hours per ton charged	2.68
H.p. hours per ton melted...	3.70
K.w. hours per ton melted	2.76

This test shows a much lower e.h.p. than when the No. 10 fan was used. It will also be noted from the tables that the average pressure was somewhat lower. The e.h.p. in heat of October 17 varied from 43.2 as a maximum to 30.1 as a minimum, a difference of 13.0 e.h.p. The heat on November 16 varied from 38.8 to 31.5, a difference of but 7.3 e.h.p. This indicates a greater decrease in outlet in the first instance than in the second. In foundry parlance, we would say that the cupola became "bunged up" in the

first instance. The rate of melting shows a decrease in the first heat, while in the latter heat the melting rate was practically constant. The reason for this is probably due to the fact that the latter heat was kept open by a mixture of some light, open scrap.

A comparison of this heat with the three previous ones will be found in Table No. 9.

Conclusions.

It is not the intention to draw any definite inferences as to the relative efficiency of the fan and the blower for cupola practice. There are, however, a few points which should be brought out to make the report complete.

1. The test has proven that, under favourable conditions, a 40 h.p. motor is sufficient to supply power for a blower or fan furnishing blast for a 54-in. cupola.

2. The rate of melting is not proportional to the amount of air supplied to cupola. Too much air will tend to cool the cupola around the tuyeres and thus reduce the melting area.

3. In a 54-in. cupola, when all heavy scrap and pig was charged, the 33 cubic feet positive pressure blower melted more economically and faster than did the No. 10 fan blower.

4. The No. 8 fan melted much more economically and faster when the cupola was kept open by a small amount of light scrap than did the No. 10 fan when all heavy scrap was used.

5. The high pressure produced by the positive pressure blower has a much more severe cutting effect on the lining than had the lower pressure produced by the fan blower.

6. The original cost and the cost of installation of the positive pressure blower would considerably exceed that of the fan blower.

7. The actual saving in horse-power is not a large item. The saving due to the shorter time taken by the blower would depend upon the number of men employed and the price of work.

8. The difference in economy between the two types of blower depends largely upon the cupola practice. The above tests would indicate that where the tuyeres were kept clean and the cupola was not packed too tight there would not be any great difference in favour of either of the types of blowers. If the tuyeres are allowed to become partly closed, the positive type would prove the better.

Addenda.

There are two or three admitted facts that should be borne in mind in the above report.

1. In order to obtain economical results in the fan blower, all curves should be avoided as much as possible and, when necessary, should be made on easy lines.

2. A fan delivers only as much air as there is a free opening for it to pass through. The horse-power required to operate the fan decreases as the free outlet closes.

3. A positive pressure blower must supply a given amount of free air per revolution. As the opening decreases in the cupola, due to closing up of the tuyeres, etc., the positive blower will force the same amount of air through this opening as it previously forced through the larger opening. It will require, however, a much larger amount of power to accomplish this.

4. The pressure of air at a cupola, as recorded on a pressure gauge, is of value for comparisons only. The number of revolutions per minute of the positive pressure blower and the amount of horse-power consumed by the fan blower are the only guides to the amount of air supplied to the cupola.

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COMPANY NEWS.

MORLEY, CARNEY & COMPANY.—Balance for the year amounts to £6,526 1s. 4d.

FRASER & CHALMERS.—Net earnings £44,511. Dividend of 10 per cent. for the year.

GALLOWAYS.—Final dividend at the rate of 5 per cent. per annum on the preference shares.

MILLOM & ASKAM HEMATITE IRON COMPANY.—Including £25,162 brought forward, a balance of £29,385.

SHEEPBRIDGE COAL & IRON COMPANY.—Interim dividend at the rate of 5 per cent. per annum on the preference shares.

KAYSER, ELLISON & COMPANY.—Interim dividend on ordinary shares at the rate of 5s. per share for the six months ended December 31.

W. & T. AVERY, LIMITED.—An interim dividend for the six months ended September 30 last, at the rate of 5 per cent. per annum.

METROPOLITAN AMALGAMATED RAILWAY CARRIAGE AND WAGON COMPANY.—Dividendon the ordinary shares of 7½ per cent. per annum for the half-year.

THE WHITING ROLLER-DRIVEN TUMBLING BARREL.

THE annexed illustrations show a tumbling barrel which is adapted for use with exhaust systems for removing the dust, and at the same time may be easily transported from place to place in the shop. This barrel is handled in Great Britain by J. W. Jackman & Company, of

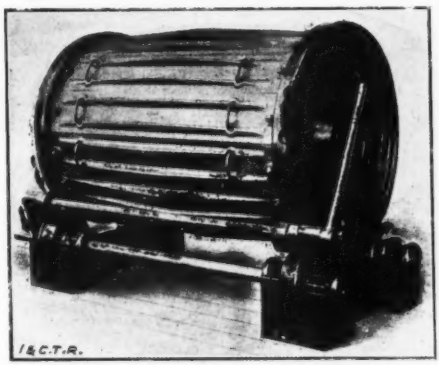

FIG. 1.—GENERAL VIEW OF TUMBLER.

39, Victoria Street, Westminster. As will be seen in Fig. 1, it consists of two heads and a number of staves. These staves may either be cast iron or wood steel lined, or the body of the barrel may be made of plate steel. In the type illustrated the staves are cast iron and held in position by a bolt at either end. There is no door or opening into the barrel, except that which may be made by removing two or more staves, according to the requirements.

The barrel itself is not attached to its driving mechanism, and may be lifted off with a crane and carried from one part of the foundry to another. It rests on four flanged wheels or rollers, two of which are drivers and the other two idlers. The drivers may be actuated either individually or in single row batteries by means of a belt from a shaft or electric motor, or a motor may be direct connected to each tumbler shaft. To stop the mill it is only necessary to depress the lever shown in the illustration. This actuates a pair of cams which lift the barrel from the driving wheels, the load being sustained by the two cams and by the two idlers. The momentum of the barrel assists in lifting its weight, so that one man can easily lift the barrel by means of the lever. The construction of the tumbler and the principle of its manipulation are well shown in Fig. 2.

Special provision is made for making the bearings dust proof. Flanges are provided at the hubs of the roller wheels and on the set collars to correspond with recesses in the bearing caps, into which they fit, excluding dirt from the bearings. The barrel heads or rims are made of chilled charcoal iron, as are also the drive wheels. The whole device is made exceptionally strong and has many advantages in point of durability.

A large number of these barrels have been in use in the malleable iron foundry of the McCormick Division of the International Harvester Company of Chicago for about a year. In actual practice at the McCormick Works the tumblers are lifted from their bearings as soon as the work is done, and are transferred by crane to the scene of the next operation, and are immediately replaced by newly-loaded barrels. In this way, by loading and unloading at central points, the tumbling mills are never idle more than the few moments required to remove one barrel and replace another, and the laborious and expensive work of wheeling castings to and from the tumbling room and loading and unloading barrels in place is avoided.

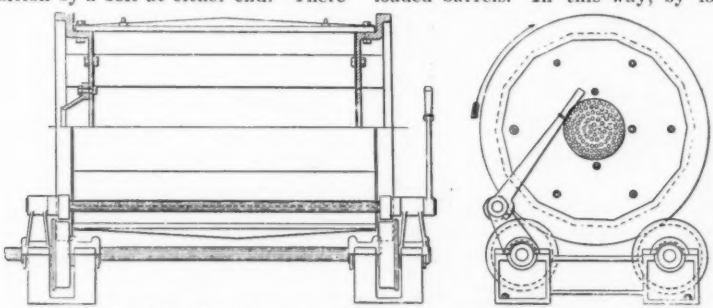

FIG. 2.—SIDE VIEW, PARTLY IN SECTION AND END VIEW, OF TUMBLER.

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THE FOUNDRY INDUSTRY OF GERMANY.

PROBABLY in this country comparatively few people are aware of the great development that has recently taken place in the foundry industry of Germany, although fully aware of the advances that have been made in the output and application of steel. And yet the fact is that within the last ten years the total production of foundry and blast furnace castings in Germany has increased from 1,147,390 tons to 1,756,275 tons, being an advance of 608,885 tons, or 33 per cent. The bulk of this advance has taken place in the foundry proper. In respect of blast furnace castings there has been an increase of trifling proportions, the total output having been 34,529 tons in 1894, and 52,213 tons in 1903. In Luxembourg, which, for statistical purposes, is included with Germany, the corresponding advance has been from 8,328 tons of castings of all kinds in 1894 to 11,119 tons in 1903. Very little, however, is attempted in the way of direct castings from the blast furnaces in the Grand Duchy. In 1897, when they were first produced on a scale of any importance, the total output was 1,689 tons, but in 1902 this figure had fallen to 90 tons, and in 1903 the output was *nil*.

A few more figures will illustrate the magnitude of the foundry industry of the Fatherland. The total number of foundries employed last year was 1,302, which compares with only 99 works engaged in the production of pig-iron, 147 works manufacturing wrought iron, and 208 works engaged in the production of steel. The number of foundries was, therefore, nearly three times that of the total number of blast furnace plants and finished iron and steel works put together. So also, *mutatis mutandis*, with the number of men to whom foundries provide employment. Blast furnaces gave work to 35,361 hands in 1903, who produced a total of 10,017,901 tons of pig-iron, and finished (puddled) iron works provided employment in the same year for 27,125 hands; but foundries employed not less than 87,821 hands, or 25,335 more than blast furnaces and puddled iron works put together. As for German steel works, they employed, in 1903, 132,443 hands, which is, of course, largely in excess of the total number of hands employed in foundries of all kinds. Although foundries employed 52,460, or 144 per cent. more hands than blast furnaces, they produced 8,026,000 tons less of products. In other words, the workmen at blast furnaces averaged about 280 tons per worker per annum, while the workers about foundries averaged only about 22½ tons over the year. It need hardly be added, by way of meeting criticism of this comparison, that its elements naturally tend to create a contrast rather than a comparison.

The average individual foundry in Germany is not a large establishment. The average of hands employed over the whole is only 67. The total quantity of material dealt with in all foundries during 1903, including both pig-iron and other descriptions, was 1,992,493 tons, and as the total volume of products realised therefrom was 1,721,781 tons, it would appear that the average loss in conversion was about 14 per cent. An exact classification of foundry products is difficult. It is attempted in the German official returns to divide them into four different categories, but the attempt may at once be pronounced a flat failure. The only specific item of which the returns are definite is that of pipes, and in 1903 the production of this form of casting was 280,929 tons. The average value of the foundry products of all kinds returned for 1903 was officially computed at 164.79 shillings, against 180.27 shillings per ton in 1901, so that the difference as between the two years was 15.48 shillings. For the same two years the average value of the foundry pig-iron produced in Germany was returned at 68.50 and 55.89, so that the decline was 12.61 shillings. In other words the average decline of value in foundry products has been nearly 3s. per ton more than the average decline in the value of foundry pig-iron.

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STANDARD PIPES AND FITTINGS.—The manufacturers of water pipes and fittings throughout Britain have decided upon the standardisation of these articles, making them interchangeable throughout the country, and improving the quality. The idea briefly is that all pipes and fittings, both lead and iron, shall be made to a standard size throughout the country. Ball valves will in future be made of gun metal. The valves of fittings and all parts are to be interchangeable, and all classes of fittings must pass a weight test of 400 lbs. of pressure to the square inch. Not only the water fittings, but the metals they are made of and the component parts, will be standardised. In order that the scheme shall not be broken through, a permanent sub-committee will inspect all new fittings and all inventions.

SOME PHENOMENA IN THE SHRINKAGE OF CAST IRON.*

By Thos. D. West.

We have, in the making of all castings, the evils of shrinkage and contractions to contend with. The former is an action reducing the bulk of metal in coo'ing down from a liquid to a solid state, while the latter implies a reduction in size after the metal has solidified in cooling down to the temperature of the atmosphere. In making castings from iron that has been re-melted in a cupola or air furnace, the softer the iron the less shrinkage found, but why the reverse should occur in making castings with liquid metal direct from the blast furnaces is a phenomenon which bears investigation. In the late use of "direct metal" in Bessemer irons for making ingot mould and other castings, the writer has been surprised to find the great shrinkage that occurs in soft irons, or those having over 1.25 in silicon compared to metal under 1.25. It is well known by blast furnace men that when direct Bessemer metal exceeds 1.25 in silicon and is below 0.03 in sulphur there is considerable escape of carbon in the form of graphite, or commonly called "kish," especially with iron low in manganese, as this element assists iron to absorb or hold carbon. This is generally so excessive with metal above 1.30 in silicon and low in sulphur and manganese that the ground will often be covered for many feet around a ladle or a pig bed with flakes of graphite, and be so mushy as to be very bad for pouring castings. Take this same metal after being poured in pigs or castings and re-melt it, and all evidence of existing freed carbon or kish coming from the liquid metal is lost. This would demonstrate that the metal after being evolved from its ores had ejected what carbon could not be held in the iron and also the great influence of silicon to repel or prevent iron absorbing carbon. Why we do not observe kish in re-melted iron is due to two factors, the first being that the excess of carbon had been nearly or all ejected from the iron when coming from the blast furnace, and then if any excess did remain it was assisted to be retained by the fact that re-melting iron reduces silicon and increases sulphur, two things which permit iron to retain more carbon than if these conditions were reversed. This clears the question of liberation of graphite to make kish, but when we return to explain the cause for the excessive shrinkage, noted above, all does not appear such an open book, as after direct metal is poured into a casting the expulsion of freed carbon, as far as evidence exists, ceases.

There appears to be a certain temperature, or that about midway between the hottest or most fluid state and the point of solidification, at which the greatest ejection of graphite takes place. High graphitic metal gives one the impression of its being affected by something that makes the metal mushy and expands its bulk. The fact that it shrinks so much before solidifying sustains the last supposition; and, as we now know, as was discovered by the writer along in 1896, that soft iron has less expansion at the moment of solidification than hard iron, it is another evidence to sustain the belief that soft direct metal is expanded while in a fluid state through the influence of freed carbon more than is the case with harder irons, and hence, being in a higher expanded state when fluid, greater shrinkage occurs at or near the moment of solidification, thus explaining the cause of the phenomena of which this article is the main subject.

Another interesting factor which the ejection of graphite would point to is to raise the question, if it is true, that all carbon finally held in liquid iron, or after the ejection of graphite ceases, is held in the metal before it solidifies as combined carbon or in a chemical form, instead of being mechanically mixed as is the case with graphite. We know it is claimed that any carbon existing in liquid iron is all held in the combined form, but the fact as shown herein that some carbon is ejected as graphite would lead to a modification of the above claims for direct metal, as we lack evidence to prove whether all the graphite is expelled before the direct metal nears its point of solidification.

Another factor to be kept in mind in connection with a study of this shrinkage question is the fact that when direct Bessemer metal gets below 0.50 in silicon and above 0.03 in sulphur, to make "white iron" in bodies under $\frac{3}{4}$ in. thick, we again have an excess of shrinkage to contend with, but which is not so great as when the metal is above 1.25 in silicon and below 0.03 in sulphur, and then, again, while we have considerable shrinkage with direct metal in hard grades, there is not near that found which occurs with re-melted hard irons of similar analysis.

The point of least shrinkage in direct metal generally occurs in irons having from 0.75 to 1.00 in silicon and 0.01 to

* From "The Iron and Steel Magazine."

0.02 in sulphur. A peculiar coincidence in this line lies in the fact that there appears to be a normal point to generate the least shrinkage, similar as in obtaining the strength of cast iron and which, as is well known, increases in attaining hardness up to a certain point, and after this is reached then the strength decreases.

In referring to the physical properties it is to be said that direct metal, of right grade, has proven superior to cupola or re-melted iron for durability in casting, subjected to heat expansion and contraction strains. In fact, all direct metal of right grade should prove better for such work in comparison to re-melted iron of similar analysis, especially where the evils of any kish can be controlled in making castings, for the reason that in its initial or first melted cooled state a greater elasticity should exist than in re-melted iron.

While it is to be said that this article presents original matter, it also sets forth with its facts ideas for valuable research, and will cause many to have something new to think about.

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JOHN BROWN & COMPANY, LIMITED, of Sheffield, are finishing, at their Atlas Works, two propeller shafts of unusual size. They measure over 80 ft. in length, are 20 in. in diameter, and are bored to a diameter of 12 in. The weight of each shaft is 27 tons.

IN connection with the bankruptcy of Knights & Talbot, Limited, of the Brockley Iron Works, Foxberry Road, Brockley, S.E., the statement of affairs issued discloses liabilities amounting to £2,050 2s. 7d., and net assets £196 12s. 1d.

MR. R. J. BRAITHWAITE, of 39, Victoria Street, S.W., has resigned his appointment as London representative of F. H. Lloyd & Company, Limited, James Bridge Works, Darlaston. Mr. F. K. Kempson has been appointed agent at the same address.

THE Kington Iron Foundry shareholders met at the registered office of the company, 32, Duke Street, Kington, on December 30, for the purpose of having an account laid before them showing the manner in which the winding up has been conducted.

THE AMERICAN CAR & FOUNDRY COMPANY has placed an order with Messrs. J. Macdonald & Son, of Glasgow, for the whole of the pneumatic equipment of the works, including four Ingersoll-Sergeant air compressors and 125 Haeseler pneumatic hammers and drills for their new works at Trafford Park.

THE PROPER ANNEALING OF CRUCIBLES.*

Too much importance cannot be attached to the proper care of crucibles after they are received at the brass foundry. Once in a while a customer writes us something as follows:—"The last shipment of crucibles received from you is defective. Some of them break even before we get them into the fire, and others flake off in the first heat." This is what is technically termed "a scalp," and no matter how much care the manufacturer gives to his work, unless the pot is properly annealed or seasoned, this scalping is liable to occur. The cause of it is moisture, which enters the walls of the crucible, sometimes clear to the centre, while the goods are in transit. A leaky goods wagon and a rainy day are sufficient to cause the trouble. It is also to be remembered that a crucible gathers moisture the same as a bucket of salt. Everybody knows that in muggy weather salt won't come out of the salt cellar, although it is inside the house and in what might be termed a dry place. The putting of crucibles in a dry place, however, may not be sufficient to prevent the scalping.

The average brass founder puts the crucibles in the back of the furnace and after a week or ten days starts in to use them, without other annealing. He places the pot mouth down on a slow fire in the morning, and if one of them happens to scalp the crucible is blamed.

We would suggest to our friends that a more severe annealing than this will not only prevent the scalping absolutely but will also increase the life of the crucible, and although it is a little bother and it will take some time to properly anneal crucibles, it will pay in the long run. If the brass shops were equipped with an oven in which they could put the crucibles and bring the heat up slowly and gradually from nothing to a red heat, the annealing would be done in two or three days, but the average foundry is not so equipped.

We offer the following suggestions, which will be found perfectly expedient in every brass foundry:—

First.—Unpack the crucibles and place as many of them as possible on the flues, back of the furnace. Here they will be heated to a sufficient degree so that they cannot be handled without burning the fingers. They should be left in this position from one to three weeks.

* Dudley A. Johnson in "Graphite."

Second.—At night, after the fires are drawn from the furnace, and the furnace is allowed to cool for, say, fifteen minutes, open the furnace wide, lay a shank across the top, place a crucible on the shank (mouth down) over the centre of the furnace, so that the remaining heat in the furnace will come up during the night and strike, not only the inside, but also the outside of the crucible. Repeat this three or four times.

Third.—Draw the fires as before, allow the furnace to cool 20 to 25 minutes, place the pot (mouth down) on the grate bars of the furnace, allow it to remain all night. Repeat the second night, only giving the furnace 10 or 15 minutes to cool off. Repeat again the third night, and this time leave the cover on the furnace.

By this method a crucible will be brought up to a red heat slowly and gradually, and whatever moisture may have been within the walls will be expelled without any steam. It is the expansion of the moisture and the generation of steam which blows a piece, or flakes, off the pot.

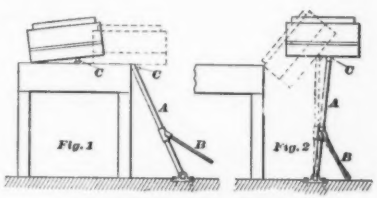
Some foundrymen will say that so much annealing is unnecessary; that they have followed a different practice for 20 years and have had very little trouble. The answer to this is: Scalps are not of frequent occurrence, and it might be a year or two between troubles of this kind, but when they do occur they are expensive. It is not every shipment that gathers moisture. We have seen crucibles taken out of the cask and immediately up into the fire without detrimental results, but the user is assuming considerable risk in so doing.

As an evidence that this "flaking off" is caused by moisture, we would say: Nobody ever saw a crucible scalp after it had safely gone the first heat, which is proof positive that the bringing of the crucible up to the heat necessary to melt brass expels from it all the moisture, consequently after the first heat there is no danger of a scalp.

A FLASK-TURNING DEVICE.

A FLASK-TURNING device for the moulder has been patented in America by Mr. Magee and Mr. W. Winchester, of the Magee Furnace Company, Chelsea, Mass. The device is described in the "Iron Trade Review" as follows:—"The device is for use in connection with a power ramming machine where the bed of the machine is elevated above the floor. On this type of machine a man is greatly limited by his physical inability to handle a large number of flasks when they are of such a size as 22 by 22 in. Mainly on this account it has not been possible to get as good results with large work as with small, and flasks as large as the one mentioned are seldom attempted with any degree of success on this type of machine. By using the device in front of the machine, as shown in the patent, the moulder is freed of all the weight of the flask while turning it over, and has corresponding increase in production."

Fig. 1 is a side elevation of a rest embodying the invention, and Fig. 2 is a similar view indicating the manner in which the flask is supported during the turning operation and is turned. The flask rest A is hinged to the floor, and is

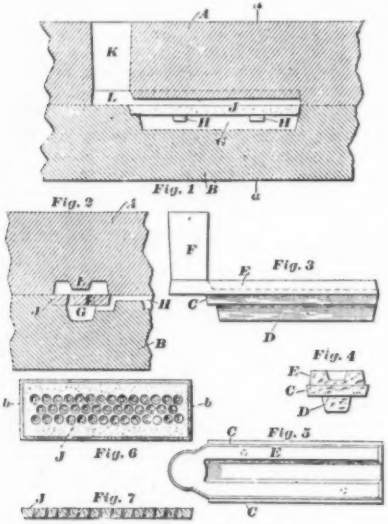


FLASK-TURNING DEVICE.

made slightly higher than the top of the bench or the table of the machine, as the case may be. The flask, as shown in Fig. 1, has been filled above the pattern plate and the bottom board let into the top ready for turning the flask in order to fill the other side. The flask rest is a bent rod comprising the rest proper, forming the cross bar, and two legs. The lower end of each leg is bent outward and fits into a bearing attached to the floor. The supporting legs have collars holding the rest D. The flask has pins or lugs C to answer the purpose indicated in dotted lines in Fig. 1, where the flask has been moved to one side, and the lugs engage the further side of the rest from the table, and the flask is thereby hooked to the rest. The moulder slides the flask along the table in the position shown in dotted lines in Fig. 1, and hooks the lugs over the cross bar. He next swings out the rest A, as in Fig. 2, and allows the front end of the flask to assume the position seen in dotted lines in Fig. 2. Where the flask is light in weight the bottom may be without projection of any kind.

A SKIM GATE FOR MOULDS.

A SKIM gate and straining core forms the subject of a recent American patent by Mr. A. Ladwig, of Milwaukee, Wis. Fig. 1 is a vertical section through a flask with this invention. Fig. 2 is a view taken at right angle to Fig. 1 on the line *a-a*. Fig. 3 is a side elevation of the drag, cope and ingate patterns in proper relation to each other, Fig. 4 is an end elevation with the ingate pattern removed,



SKIM GATE FOR MOULDS.

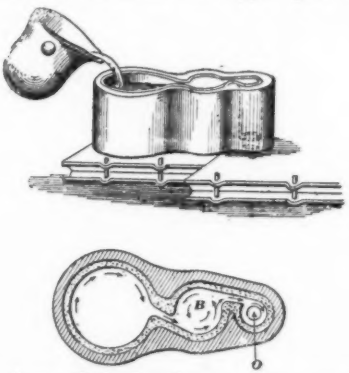
and Fig. 5 is a plan view. Fig. 6 is a plan view of the skim gate core, and Fig. 7 is a sectional view taken on the line *b-b* of Fig. 6. A and B represent the cope and drag of a moulder's flask. The drag pattern, Figs. 3, 4, and 5, has a flat core print C with bevelled edges and a channel D, on the under side, and having the sides and ends tapering toward the rounded bottom. The channel pattern D is narrower than the core print pattern and is shorter to form a shoulder. The cope pattern consists of a gate pattern E with a projecting circular end having sloping sides to connect with the edges of the gate pattern, and the two are secured by dowel pins. The ingate pattern F is of the usual shape. The patterns form a channel G in the sand of the drag having shoulders along the sides and at the end. The gate has a depending flange formed in the upper wall by the groove in the gate pattern. One or more gates H are formed in the drag leading from the channel D to the mould. A core, Fig. 6, of clay or oil sand, etc., has rows of perforations and fits on the seat as shown in Figs. 1 and 2. The gate H is suitably shaped to pass the core, and is closed from the channel to the parting line by it.

When the flask is closed and metal passes through the ingate, it flows over the core J and into the openings to the channel G. The metal flowing to the gate faster than it passes through the perforations, rises in the gate, and the slag rising on either side of the flange leaves only the pure metal to pass the openings in the core.

TO PREVENT BLOW HOLES.

AT the foundry of Mons. H. Bollinckx, the well-known engine builder of Brussels, Belgium, the device shown in the annexed cut is used in making castings. It was devised by Mr. Van Riet, and prevents blow holes, and also prevent impurities which are found in pig-iron entering the mould.

A foundry ladle filled with melted metal has impurities on its surface, and if they are removed other impurities will rise to the surface. These impurities cause blow holes on the upper part of



castings. Indeed, when a very smooth surface is required on a casting, it may have to be cast upside down. With Mr. Van Reit's system this is no longer necessary.

The apparatus is very simple and is made of cast iron, lined with clay, mixed then with water.

As seen by the arrows, the metal has a motion of rotation, and owing to centrifugal force all impurities are separated from the metal before entering by the holes *O* in the mould. At *B* a great porous mass will be collected.

COST OF PRODUCING STEEL CASTINGS BY THE OPEN-HEARTH PROCESS AND THE SMALL CONVERTER.

By L. Unckenbolt.

The small open-hearth furnace and the small converter are not really rivals, each having its proper field of action and suitable uses, and any attempt at replacing one by the other will prove an economic failure. A 4 to 5 ton open-hearth furnace for cast steel can only produce castings exceeding about half an inch in thickness and 1 cwt. in weight, without wasting three to four tons of the charge; the contents of the furnace cooling down so quickly during the casting that the steel becomes insufficiently fluid to run into small moulds. Now the converter enables castings of any size to be made, and is particularly profitable when those of small dimensions (less than ½ in. thick and 1 cwt. in weight) are to be produced; in fact, Belgian founders make, by its aid, castings of 1 lb. weight and ⅛ in. thick, such as could only be obtained formerly with crucible steel, malleable castings, or the hydraulic press. However, it is not advisable to erect a steel plant solely for the production of small goods on which a large profit is made, the work of casting being in this case very complicated. In order to avoid this inconvenience, it is necessary to produce large articles as well, in a proportion that can easily be determined by experience.

The cost of a simple steel plant, with a single cupola capable of treating about 3 tons per hour, and a 1-ton converter, will be—for the cupola, £80; the fan, £20; the converter, £200; the blower, £100; the re-heating furnace, £40; the drier, £40; the sand blast machine, £120; two drums and two mills, £40; several casting ladles and other accessories, £120; crusher and disintegrator for sand, £40; small pattern shop, £80; total, £880.

Should the business after a while entail an increase in the plant, the following additions could be made: A second drier, £60; a second re-heating furnace, £60; an electric welder for repairing small superficial defects, £200; several grinding machines, £100; one or two cold saws, £60; a small chemical laboratory, £120; a testing bench, £80; total, £680.

To this outlay must be added the cost of buildings, source of motive power, a hoist, a platform for the cupola, a weighbridge for the yard, and a 5-ton travelling foundry crane, the whole amounting to £2,000 to £3,000.

Statements have recently appeared in the German technical Press to the effect that small converter steel plants can be erected at less than the above figures; but it is hardly probable that such plants would be able to compete with those already existing, it being essential to success to furnish consumers with a good article, quickly, and at a low price.

The motive power required will be 5-10 h.p. for the fan, 5 h.p. for the hoist, 50 h.p. for the converter blower, 7-10 h.p. for the sand-blast machine, 10-15 h.p. for the drums, 5-10 h.p. for the sand-preparing machinery, and 3-5 h.p. for the pattern shop. Later on this can be increased by 5-10 h.p. for working the converter, 30-40 h.p. for the electric welder, and 10-15 h.p. for the saws, lathes, travelling crane, planing machines, and testing bench. It will not be necessary to keep all the machines working continuously; for example, to produce one ton of steel, the cupola fan is worked for half an hour, the converter blast half an hour, the converter mechanism three to four minutes, and the hoist five minutes. In this way, a 100 to 300 h.p. engine will be sufficient, though it is always better to have too much power than too little. A travelling crane of 5 to 7½ tons capacity is a prime essential, since it will enable all orders to be executed, even with only a single cupola and one converter.

The steel from the converter is at such a high temperature that several charges can be collected into a large heated ladle, so that very large castings can be produced when required. The author has made castings of 3 to 5 tons each in this way without difficulty.

The cost price may be calculated as follows:—To obtain one ton of molten steel, as it issues from the converter, the materials required will be: 14 cwt. of Bessemer iron, at 56s. = 39s. 2d.; 4 cwt. of hematite pig, at 62s. 6d. = 12s. 6d.; 5¼ cwt. of scrap, at 44s. = 11s. 6d.; ½ cwt. of complementary materials (ferro-manganese, ferro-silicon, ferro-aluminium) = 5s. 8d.; 4⅝ cwt. of foundry coke, at 17s. 6d. = 4s. 2d.; 2½ cwt. of gas coke for heating the ladles, drying the moulds, etc., = 1s. 6d.; or together, 74s. 6d. as the cost of the ton of steel. From this quartity must be deducted 5 cwt. for waste in casting, and worth only the price of scrap (44s.), viz., 11s., leaving 15 cwt. of steel costing 63s. 6d., *i.e.*, 84s. 8d. the ton.

The cost has to be increased by the items for labour, upkeep, and motive power, as follows:—In respect of labour, there will be needed, for an output of 25 tons, two men for the cupola, at 3s. 6d. = 7s., and two for the converter at the same rate of pay, or 14s. in all, which

works out at a little over 7d. per ton. With regard to the upkeep of the cupola and converters, a 1-ton converter, working every day, will usually give 60-80 pourings before needing repair; but assuming that it needs repair once a fortnight, and that during this period 50 pourings have been made, the refractory lining will cost £5 and the labour 14s., which, together with 6s. for the repair of the cupola, makes £6 for an output of 50 tons, or 2s. 5d. per ton.

To produce 25 tons a week will entail the following outlay for motive power:—5 h.p. for 1½ hours to work the hoist, costs 1½d.; 10 h.p. for 12½ hours driving the cupola fan = 2s., and 50 h.p. for an equal period, driving the converter blower, costs 10s., or 12s. 1½d. in all, making in round figures 6d. per ton. The total cost of the ton of steel is therefore 84s. 8d. + 7d. + 2s. 5d. + 6d. = 88s. 2d. This may seem high, but is an outside figure, having been obtained on the basis of an output of 20 to 25 tons per week with a plant consisting merely of one cupola and a single converter. Hence the cost would be considerably reduced in a plant with two converters, since in the latter case a larger number of pourings could be made without interruption, thus greatly diminishing the outlay for coal and coke.

No doubt the objection may be urged that steel can be produced much cheaper in the open-hearth furnace; but it should be remembered that this furnace, when once started, must be kept going at all hazards, whatever the state of the market, a condition that will undoubtedly prove onerous in the long run. With the converter, on the other hand, work can be suspended when trade is bad and orders slack; so that no loss is being incurred even if no profit is being made.

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Messrs. Willans & Robinson, Limited, of Rugby, erected an extensive steel foundry some time ago at Queen's Ferry, on the banks of the Dee, in Flintshire, where they succeeded in making tube steel of a quality which it is claimed cannot be distinguished from the best Swedish steel, although made entirely from English material, they had also produced forging steel of high quality, as well as some special alloy steel. The company have received so many offers of future orders if they would again open the works, that they have now decided to do so, and production will be commenced immediately after Christmas. At present the staple production will be tube steel and steel for crankshaft and other forgings, but special alloy steel will also be made.

TEST OF THE McCLELLAND MOULDING MACHINE.

In the January, 1902, issue of the Foundry Trade Journal a description was printed of the McClelland moulding machine, which is made by the Safety Tread Syndicate, of 15, Barbican, E.C. We have nothing to add to the description then printed, but we were recently shown two photographs which were taken of a test made with the object of determining the relative amount of work that could be got through by hand and by aid of the McClelland machine. The two photographs reproduced on the opposite page, show the difference so clearly that further description is unnecessary. It will be seen that in two hours eight complete moulds were made by hand as against thirty complete moulds by machine.

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PERSONAL.

The late Mr. George Brockley, of the Poplar Copper and Brass Works, left estate valued at £50,488 gross and £47,867 net.

Mr. J. E. Ransome, of Ransomes, Sims & Jefferies, Limited, Ipswich, has been appointed a Justice of the Peace for the borough.

Mr. H. F. Golding, chief draughtsman to the Taff Vale Railway Company, has been appointed the Company's locomotive superintendent at Penarth.

Mr. J. F. Cay, of the Patent Shaft & Axletree Company, is among those recently having given evidence before Mr. Chamberlain's Tariff Commission.

Mr. Orcutt, lately London manager of the firm of Ludwig Loewe & Company, of Berlin, has been appointed general manager of Clayton & Shuttleworth, Lincoln.

Mr. H. Cooper, for many years connected with Vickers, Sons & Maxim, Limited, has been appointed a director of Hadfield's Steel Foundry Company, Limited.

Mr. Ernest Gearing, general manager of the Leeds Forge Company, Limited, has been made a director of the company. Mr. R. W. Storey has been appointed secretary.

Mr. G. N. Cook, manager of the foundry department of Messrs. Thomas Firth & Sons, Norfolk Works, Sheffield, has resigned, and is shortly leaving for Australia.

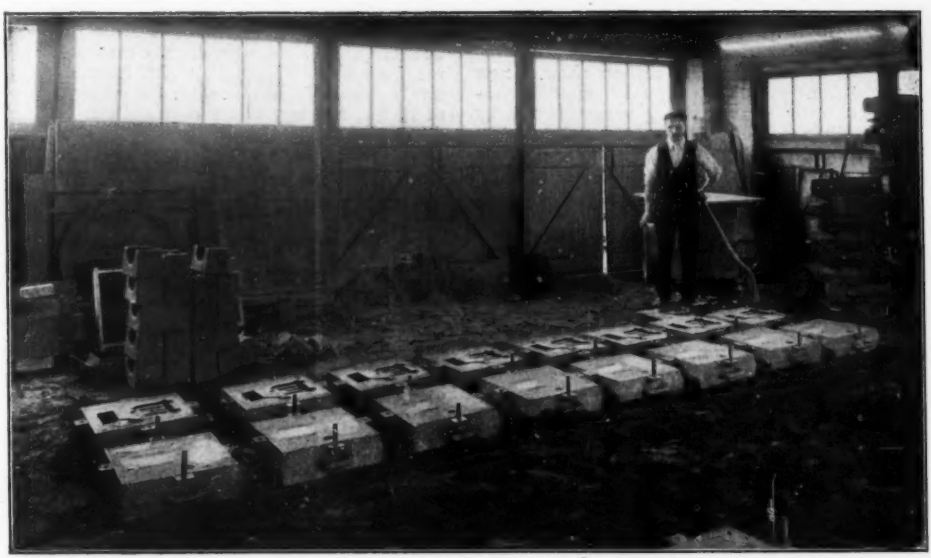

FIG. 1.—TWO HOURS' WORK BY HAND BY STEADY AND RAPID MOULDER—EIGHT COMPLETE MOULDS.

FIG. 2.—TWO HOURS' WORK BY MACHINE BY ONE MAN—THIRTY COMPLETE MOULDS.

A MECHANICAL PATTERN-MAKER.

THE annexed illustrations show a new and ingenious machine for making patterns that has recently been designed by Messrs. Wadkin & Company, of Evington Works, Leicester. This machine, of which a general view is shown in Fig. 1, may also be used for practically all kinds of woodworking, except sawing, planing, and thicknessing. Indeed, it is somewhat difficult to give a full list of its varied applications, but the following will afford some idea as to its range of work :—Regular and irregular moulding, tenoning, dovetailing, boring, turning, trenching, tracery, fluting, and moulded work of every description, and all classes of millwrighting. The variety of work which this machine is capable of doing renders it valuable not only in large shops, but also in small ones. The machine, as will be seen in Fig. 1, consists of a massive solid cast-iron frame, supporting a long circular-shaped rocking-arm carrying the spindle head, and a cast-iron table running on rails that are a part of the main bed-plate. The two brackets for carrying the countershaft are bolted on to the back of the frame casting, and on the top are two trunnions for supporting the cast-iron rocking-arm. This arm, which is sensitively balanced, has a vertical movement of 16 in., and any angle required can be set in that range. At the front of the arm and fastened to it by bolts is the spindle head, which can be turned through any angle from the vertical to the horizontal. In order to enable the head to be fixed at any angle, a graduated scale B is provided.

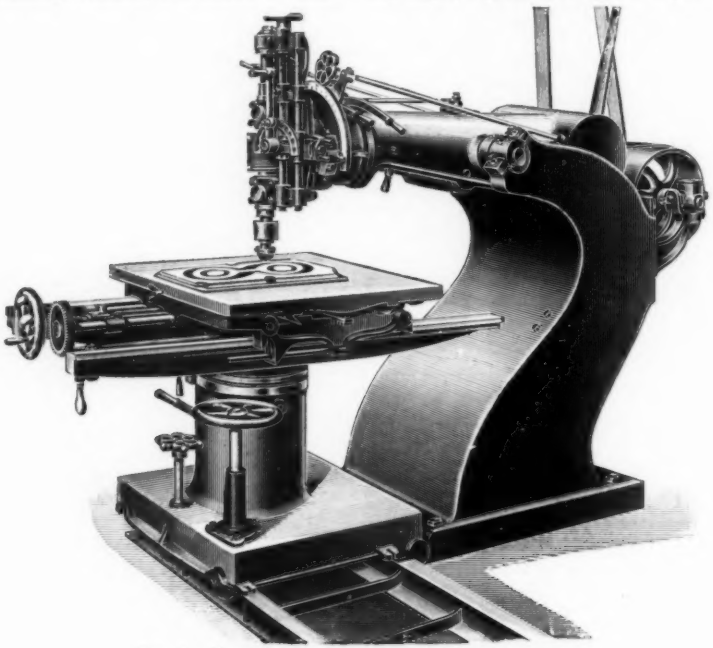

FIG. 1.—THE WADKIN MECHANICAL PATTERN-MAKER.

The vertical movement of the spindle is obtained much in the same way as in a drilling machine, a definite feed being given to it as desired, regulated by the sector S. The handle C is used for raising or lowering the spindle, with a positive movement, the device being quick-acting. Fine adjustments are made by a micrometer screw. A pulley, belt-driven from the countershaft, is keyed on to a spindle, and to allow for the vertical movement of the head there are compensating pulleys in the rocking-arm. The striking lever is conveniently arranged behind the spindle head and can be operated from either side of the machine.

The table is carried on a supporting column made of cast iron, carried on rollers which run along rails. The table is propelled along the rail by means of a pinion keyed on to the spindle S, which gears into a bevel wheel fixed to one of the rollers. The screw-clamp T grips the rail and fixes the table in position. An accurately-turned cored column, which fits the circular recess in the main body, carries the table. It is supported on a telescopic screw resting on a nose, which works in an oil bath. The vertical motion is also actuated by this screw passing through a threaded sleeve, which is cast into a column, allowing a vertical movement of 12 in. Adding this to the 16 in. through which the rocking arm works a total range of 28 in. is obtained. The table has also a lateral and cross section motion, which is regulated either by a screw or a quick hand adjustment, and can be turned through a whole circle horizontally. Automatic stops are used throughout the machine, thus facilitating and ensuring accuracy in repetition work. The machine, it will be observed, has a nearly universal movement and a large range of action. Figs. 3 and 4 show two positions illustrating this. This feature dispenses with a large number of special devices and jigs,

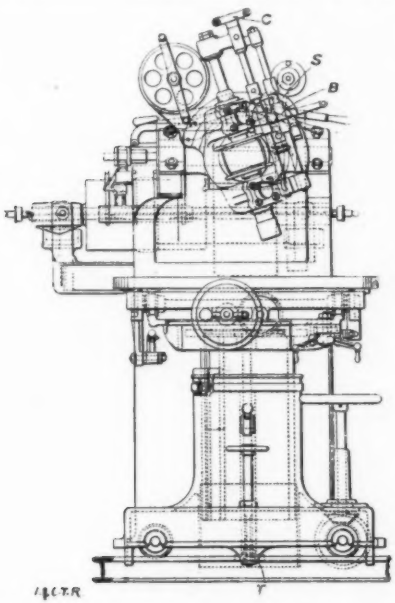

FIG. 2.—WADKIN'S MECHANICAL PATTERN-MAKER.

and, consequently, the work can be produced at a minimum cost. The machine is driven in the usual manner from the main shafting or by motor, direct on to the cutter spindle.

A few samples of the work done are shown in Figs. 5 and 6. In the case of Fig. 5 the following table shows a comparison of the time taken by machine and by hand :—

Comparisons with Machine against ordinary Methods.

No.		Usual method.	By machine.
		About	About
1	Valve core box	10 hrs.	2 hrs.
2	" " "	20 "	1½ "
1	Sprocket wheel 4 in. ...	4½ "	15 m in.
2	" " " 12 in. ...	15 "	20 "
3	Spur wheel 10 in.	29 "	2 hrs.
5	Helical gear, ½ pitch, 38 teeth	27 "	40 min.
22	Worm 7 in. long	15 "	15 "
6	Cutter head	14 "	1¼ hrs.
1	Pipe pattern, 28 ft. rad., 4 in.	8 "	½ hr.
2	Pipe pattern, 18 ft. ...	8 "	½ "
3	Pipe core box, 28 ft. ...	10 "	½ "
4	" " " 18 ft. ...	10 "	½ "
5	" " " 8 ft. ...	10 "	½ "
6	" quarter bend 4 in.	10 "	½ "

In the case of Fig. 6 the comparison is as follows :—

No.		Usual method.	By machine.
		About	About
24	Cylinder automatic drain cock...	7 hrs.	20 min
25	Double socket syphon or return bend with outlet connection	6 "	20 "
26	Breeches piece	4 "	25 "
28	Long sweep junction, with double socket and spigot	7 "	20 "
29	Sinking—any dimensions	—	—
30	Specimen showing deep taper port holes ...	6 "	20 "
31	Straight core boxes, worked in long lengths and cut up as required	—	—
32	Square section bend ...	7 "	20 "
34	Round sinking — any dimensions	—	—
35	Cylinder end...	3 "	30 "
36	Corliss engine, cross head	9 "	30 "
37	Quarter bend, with socket and spigot	7 "	18 "
39	Obtuse bend, with socket and spigot	7 "	15 "
40	Reduced cross junction ...	4 "	12 "
41	Eccentric sheaf	5½ "	40 "

The expanding grooving disc cutter—Fig. 7—will expand from ⅜ in. to 1¾ in. Any required width of cut from ⅜ in. to 1¾ in. can be got. The cutters are removable.

In the router cutter—Fig. 8—the cutters are also removable.

In both cases the cutters maintain their cutting edge in a state of efficiency much longer than most cutters, because they

are sharpened and ground on their inside edge. They are also interchangeable. Special tools can be made to suit any class of work, but for simplicity and cheapness a large number of the tools are merely fly-cutters. This class of cutter can, in some cases, be adapted for cutting different sized holes; and different cutters can be used on the same spindle. Large cores up to 12 in. diameter can be cut with ease.

Routing cutters are made for routing out the heavy bodies of patterns, and these will take a cut of 1½ in. at a time. Gear cutting can also be done, the methods being the same as on a universal milling machine, the correct spacing being obtained from a screw on the table geared into a dividing head in the ordinary way. Curves up to any radius can readily be cut upon this machine.

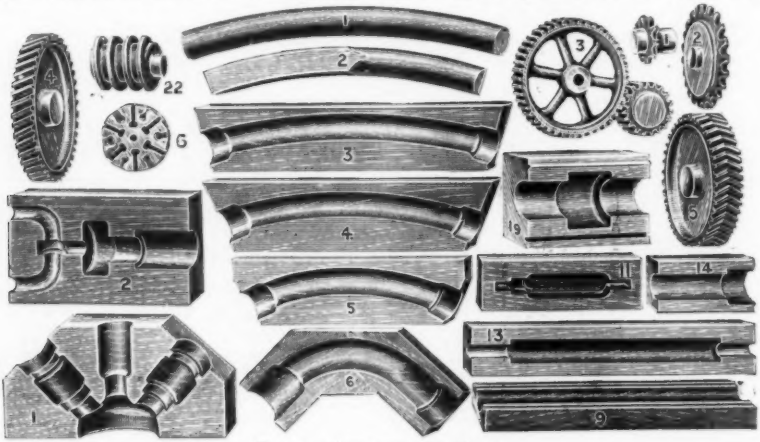

FIG. 5.—SPECIMENS OF WORK.

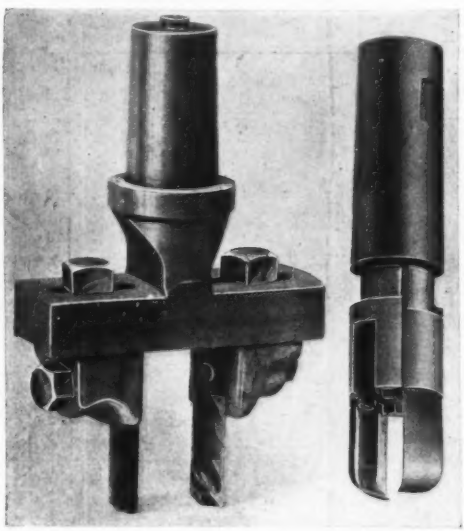

FIG. 7.

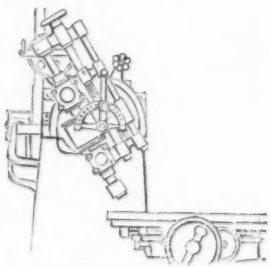

FIG. 3.—SPINDLE HEAD CANTED.

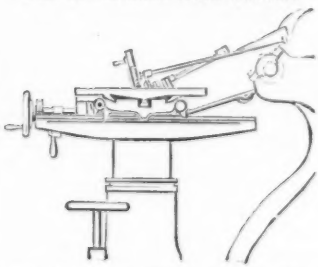

FIG. 8. FIG. 4.—HEAD DIPPED BELOW TABLE.

COMPRESSED AIR IN FOUNDRIES.

THE applications of compressed air in the foundry are now almost too numerous to mention. A large amount of time can, for instance, be saved in the fettling-shop by supplying the dresser with pneumatic hammers which, in the cutting off of fins and gits, etc., cannot be approached by the best hand chipper extant. Especially is the saving shown in dressing heavy castings.

Not only has a plant been found beneficial in the more or less stereotyped applications to sand sieving and fettling, but in a score of other directions it has made itself a welcome addition to the foundry plant and an ideal solution to some of the many perplexing problems which almost daily present themselves in a large-sized foundry. Perhaps an instance will suffice to show the usefulness and advantage to be gained by a compressed air supply. A number of flash boilers had to be made. These boilers, when made, consisted of a coil of steel tubing entirely embedded in cast iron. As the tubes had to stand a steam pressure when in use of 100 lbs. to the square inch, and would thereby be subjected to a continual expansion and contraction, it was manifest that the tube should be injured as little as possible by the molten metal being poured round and about it, and to this end, having an outlet and inlet branch, one end was connected to the air supply, and during the process of casting a continuous current of cold air was blown through, and was found to be efficacious as a means of protection to the tube. Advantage was taken of the now well-known fact in connection with compressed air, viz., the great reduction in temperature which occurs when expansion takes place. In some classes of long slender castings, such as piping, where the core is built round a thin tube, and, as is sometimes specified, chaplets have to be very sparingly used, the cooling effect of a current of compressed air will be found a very useful and convenient expedient to use to prevent the core being lifted in the middle by the molten metal.

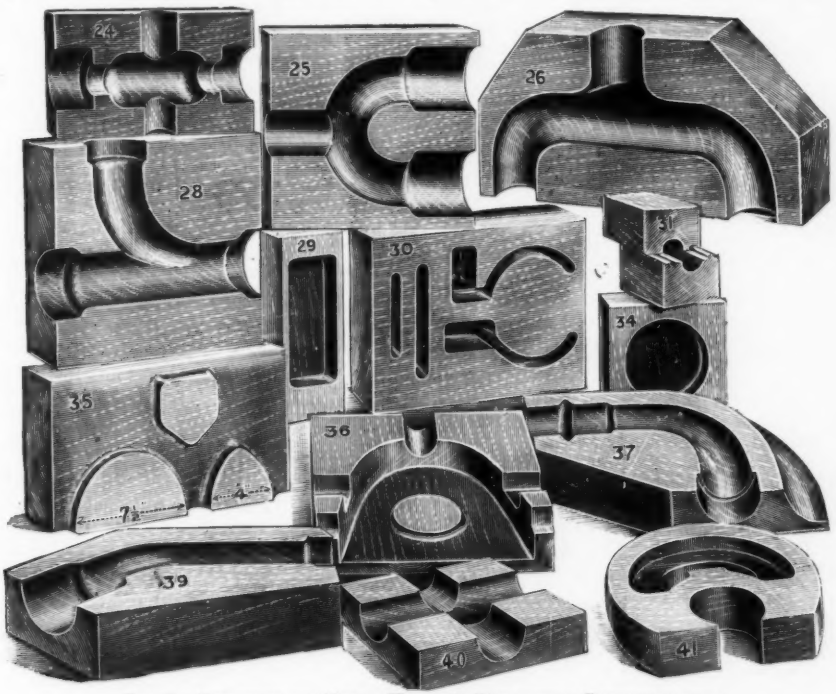

FIG. 6.—SPECIMENS OF WORK—WADKIN'S MECHANICAL PATTERN-MAKER.

COMBINATION MOULD AND LADLE FOR CASTING SOFT-METAL HAMMERS.

One of the tasks that falls to the lot of the foundryman occasionally is to cast soft-metal hammers. For this purpose a handy combination mould and ladle has been introduced by the American Mill Supplies Company, of 25, Victoria Street, London, S.W.

The accompanying illustration (Fig. 1),

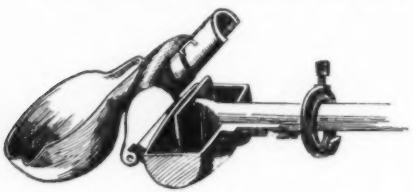

Fig. 1.

shows the mould open, with the handle in place.

The mould is then closed and fastened with ring, shown riding loose on the handle, and it then is ready for the fire. The position of the ladle on the mould is such that, by simply depressing the handle from the position shown in Fig. 2 to a horizontal position, all the metal in ladle will flow into the mould and surround the end of the handle. It only requires that the metal should be just melted, not heated

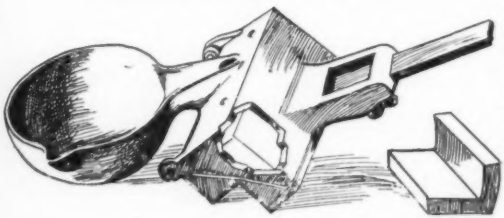

Fig. 2.

above that point, as in melting the metal enough heat is conveyed to the mould to allow the metal to run freely into mould.

The handle consists of a piece of pipe, forged so as to form a T-shaped end, see Fig. 1, which can be furnished in any number with the mould probably cheaper than they can be made. An ordinary pipe-fitting T will answer the same purpose, however, but before putting same on, the end of the pipe will have to be plugged to prevent metal flowing into the pipe. The ladle can be used for other purposes, such as babbitting bearings, etc. With this device there is no liability of the head of the hammer being jarred off, and after becoming shapeless it can be melted in same ladle and run on to duplicate handles. Aluminium hammers may be made with this same device, for lighter use; but the heat required to melt it is so much greater, its continual use for that purpose is detrimental to the mould.

—o—

Tenders for Cast Iron Tanks.—Upwards of fifty firms submitted tenders for the supply and erection of seven cast-iron water-tanks required for the first portion of the Greenwich generating station. The lowest tender received by the L.C.C. was for £1,173 12s. from S. Russell & Sons, of Leicester, while the highest amounted to £2,847, from T. Lister & Company, Limited, of Brighouse. The committee appointed to consider the tenders recommended the acceptance of the former. Appended are some of the principal offers sent in:—British Hydraulic Foundry Company, Glasgow, £1,365 1s. 6d.; Horsley Company, Limited, Tipton, £1,375 4s. 5d.; Ashmore, Benson, Pease & Company, Limited, Stockton-on-Tees, £1,371; Whessoe Foundry Company, Limited, Darlington, £1,389; Holwell Iron Company, Limited, Melton Mowbray, £1,411 11s. 11d.; Newton, Chambers & Company, Limited, Sheffield, £1,426 6s. 4d.; Patent Shaft and Axle Tree Company, Limited, Wednesbury, £1,436 16s. 8d.; Sheepbridge Coal and Iron Company, Limited, Chesterfield, £1,460 7s. 6d.; Railway and General Engineering Company, Limited, Nottingham, £1,475 10s.; Phœnix Foundry Company, Limited, Derby, £1,517 7s. 1d.; Tibbington Foundry Company, Tipton, £1,568 2s.6d.; Ransomes & Rapier, Limited, London, £1,577 1s.; C. & W. Walker, Limited, Newport, Salop, £1,645 9s. 8d.; Head, Wrightson & Company, Limited, Thornaby-on-Tees, £1,700 18s. 6d.; J. Cochrane & Sons, London, £1,725 10s.; ditto (alternative), £1,630; Stanton Ironworks Company, Limited, Nottingham, £1,727 5s. 10d.; Mather & Platt, Limited, London, £1,778 4s.; Ashton & Green Iron Company, London, £1,928 10s.; Widnes Foundry Company, Limited, Widnes, £1,961 3s. 3d.; Northamptonshire Direct Castings Company, Limited, Wellingborough, £2,024 8s.; Caledonian Engineering and Shipbuilding Company, Preston, £2,585.

THE ECONOMIC VALUE OF CAST IRON.*

By W. H. Pretty.

The art of casting in iron is of comparatively recent introduction when considered along with the historic records of the use of bronzes for casting into moulds of specific form.

It is probable that the development of the art of casting in bronze, necessitating the introduction of larger furnaces, coupled with the higher temperature thus attainable, may have led to the production of castings in iron, since we read of one Theodoros of Samos and others making statues in cast iron about 500 years B.C., and at a time when bronzes were well

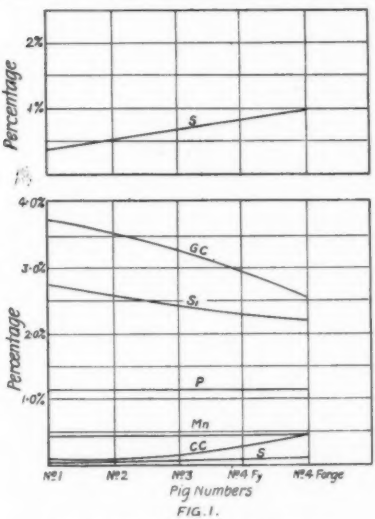

FIG. 1.

The top curve is in decimals of 1 per cent.

known; these castings in iron, described as of very fine workmanship, were regarded as curiosities in the second century A.D.

Very little is known of the industry until we reach the sixteenth century, when iron castings were made in Sussex, but the furnaces producing the iron were stopped on account of the large consumption of timber used as fuel. Early in the seventeenth century attempts were made to produce cast iron with coal, presumably with success, since a mob representing the charcoal burners and others appeared on the scene to dismantle the furnaces. A later attempt to use coke, which was successful, was abandoned owing to opposition.

Early in the eighteenth century cast iron cannon were made in Kent and Sussex, and almost simultaneously castings in iron

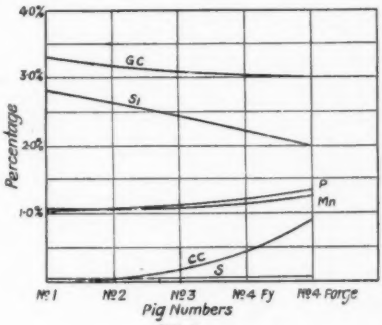

FIG. 2.

for peaceful purposes were produced at Coalbrookdale in Shropshire. From this time onwards the industry grew rapidly, and the introduction of the steam engine and blowing cylinders enabling a more powerful blast to be used, may be taken as the commencement of our present-day ironfounding now carried on so extensively for various purposes.

Occasionally very fine examples of iron castings are found in old country houses,

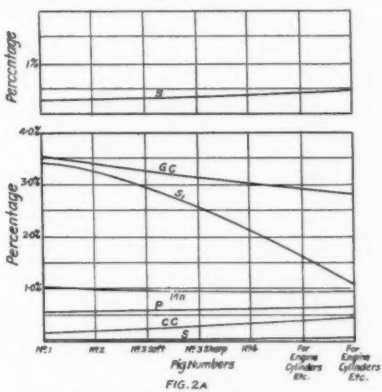

FIG. 2A

The top curve is in decimals of 1 per cent.

and known as firebacks, frequently in an excellent state of preservation and dated with the year in which they were made; we have also specimens existing of the very fine examples of fancy iron castings made in Berlin during the Napoleonic wars, and rendered historic by the ladies giving up

* Paper read before the Manchester Association of Engineers.

their valuable ornaments and jewellery for the service of their country in the struggle with Napoleon I., receiving in return cast iron ornaments with the inscription "Ich gab gold um eisen" (I gave gold for iron).

The author gives these few historic notes with a desire to interest the members of this Association in the collection of specimens of cast iron representing different periods, as they will prove valuable in research work.

The general introduction of iron castings has played an important part in the economical use of other metals, such as copper, tin, etc., and has set free the world's supply of bronzes and the metal used in their formation for more valuable

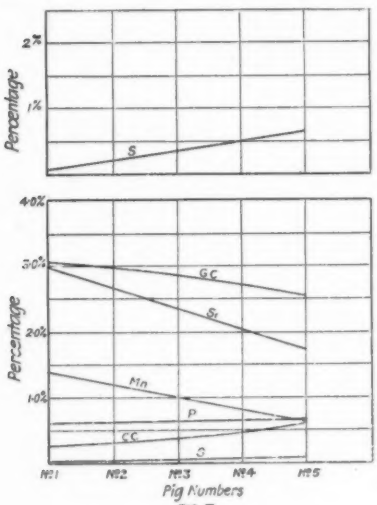

FIG. 3.

The top curve is in decimals of 1 *per cent.*

purposes, while the great cost of copper and tin even now is almost suggestive of their being classed with the rarer elements, and is indicative of what might have been to-day without the aid of cast iron.

There are matters in which the iron-founder is almost unaided at present—viz.: the rapid and accurate measurements of high temperatures by simple and handy instruments, and the "chemistry of high temperatures," so far as they affect his metals, mixtures, and refractory materials; but there are indications that this assistance will soon be available.

The most important applications of cast iron (under which term is included pig-iron) at the present time may, perhaps, be broadly classed as follows:—

1. Its use in the production of wrought iron, steel and ingot iron, etc., essentially of a metallurgical nature.

2. Its use in the service of mankind by civil engineers and others for structural

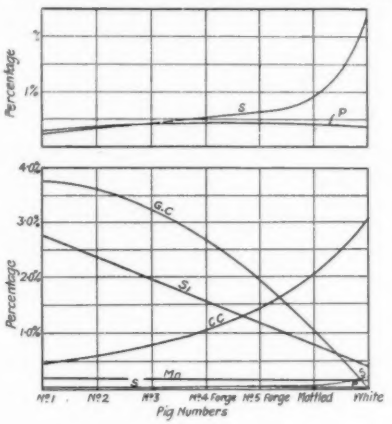

FIG. 4.

The top curves are in decima's of 1 *per cent.*

work, bridges, tunnelling, pipe lines for water supply, and other purposes.

3. The production of castings for the general use of mechanical and electrical

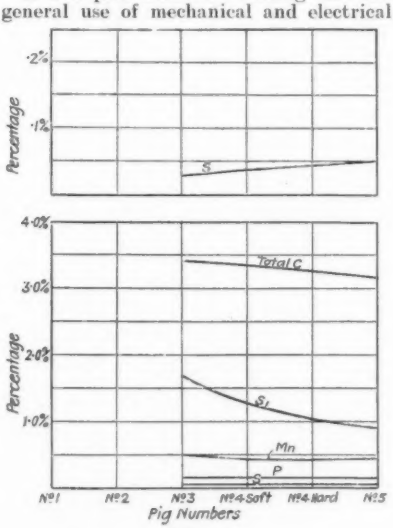

FIG. 5.

The top curve is in decimals of 1 *per cent.*

engineers in the construction of machinery, steam engines, and other prime movers, etc.

4. The reproduction of works of art,

ornamental ironwork, and various articles required for domestic and other purposes in times of peace.

5. The manufacture of malleable castings.

The field covered is a very wide one. Class 2 is gradually passing into the hands of ironfounders possessing blast furnaces, for obvious reasons, but is still practised on a small scale by founders engaged in Class 3, while it would seem that Class 5 is likely to be replaced by steel castings.

The author has had the privilege of being in direct contact with various ironfoundries for many years in a metallurgical capacity, and has also been in touch with the machine departments, toolroom, and testing of materials simultaneously,

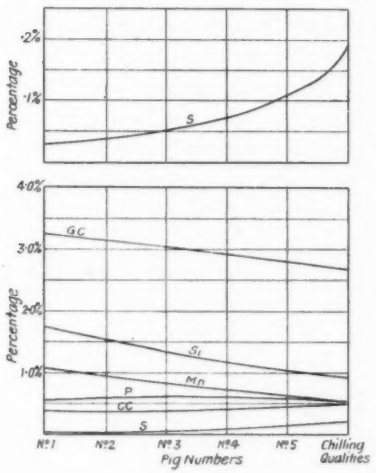

FIG. 6.

The top curve is in decimals of 1 *per cent.*

and he has chosen the irons used in Classes 2, 3, and 4, with particular reference to Class 3, for the basis of the subject matter for this paper.

The pig-irons produced at hot blast furnaces are generally graded as "No. 1 to No. 4 foundry"; "No. 4 to No. 5 forge, mottled and white"; and at cold blast furnaces as "No. 1 to No. 5, mottled and white." This is not a hard-and-fast rule, however, for grading pig-irons, but it has been long established and is generally understood. It would be far better, in the author's opinion, to grade these irons by analysis, even if only approximately correct.

It may be urged that the fracture of the pig is a sufficient guide. But this is not so, except perhaps in the case where we are dealing with the same product, produced at the same furnace, cast under similar conditions of temperature, etc., and even then it takes an experienced man who has a full knowledge of the manufacture in question to grasp the possibilities of the material he is dealing

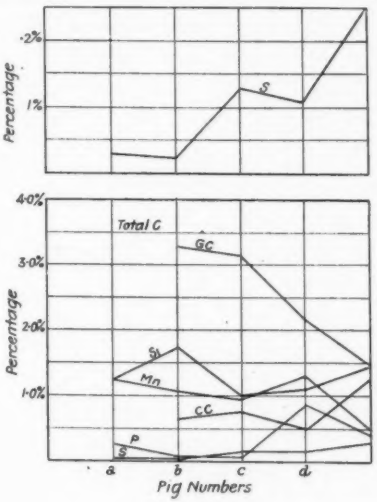

FIG. 7.

The top curve is in decimals of 1 *per cent.*

with. These difficulties are increased today by machine-moulded pigs cast in chills, etc., and by the competition in manufacture among pig-iron producers, and the author takes this opportunity for suggesting that a grading of pig-irons by analysis, combined with a few physical and mechanical tests, is a fitting subject

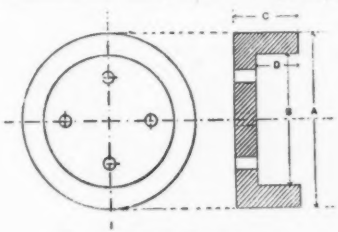

FIG. 8.—TEST SPECIMEN.

for research and inquiry by engineers who require iron castings for specific purposes.

We will now consider a plan used by the author for expressing in a simple way the changes in analysis in the various numbers of any particular brand of pig-iron, and called by him the "brand

characteristic," and which he has found to be of much use in estimating the economic value of pig-irons for various purposes. Each "brand characteristic," as the name implies, deals with one production only, and shows graphically and at a glance the nature of the iron under

could be at once described to a customer by indicating the change in the "brand characteristic" that will result, and the founder, with increased metallurgical knowledge, would know how to meet it.

In what follows, the curves represent average results, and the samples are

Transverse test for cast iron only, standard bar 2in. deep, 1in wide, 3ft. between points of support, tested on edge with load at centre

Number of Test.	Date of Casting	Date of Making the Test.	Maker of Material.	Breaking Load. Cwts.	Qrs.	Lbs.	Deflection at centre in inches.	PIG IRON. Brand and No.	Hot or Cold Blast.	Quantity of each in Cwts.	Weight of Iron Mixed Cwts. Charge Cwts.	COKE. Brand and Maker	Bed Coke, Cwts.	Coke per Charge Cwts.	Air pressure of Blast in Inches of Mercury.	Furnace used.	Purpose Metal is intended for.	Remarks.

FIG. 9.—FOUNDRY TEST SHEET USED BY GIMSON & CO., LTD. (LEICESTER).

investigation; these curves must not be drawn from a few isolated analyses, but to be of any real value should be taken over a wide range of tests in order to get average results, and in spite of the smelter's plea that it is neccessary to accompany an analysis with the statement

chosen as fairly representing the particular curves they have been chosen to illustrate. The prices given are only intended as approximations and for comparative purposes, and will obviously be affected by the cost of carriage to various places.

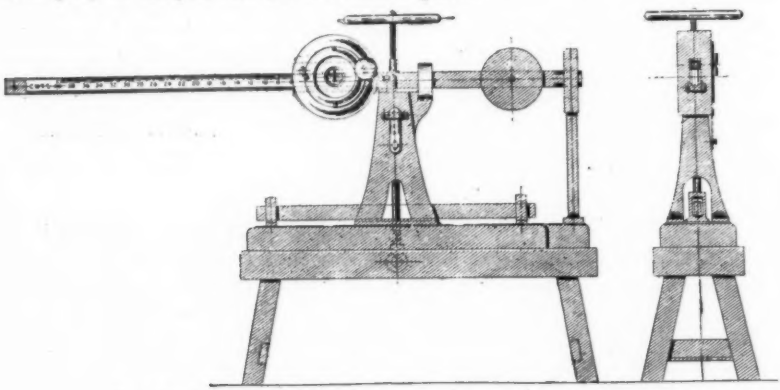

FIG. 10.—BAILEY'S TRANSVERSE TESTING MACHINE. CAPACITY, 40 CWT.

"without guarantee," the results from any one furnace in skilful hands are of a remarkably uniform nature. Such curves would further be useful in dealings between the blast furnace proprietors and the regular purchasers, inasmuch as a variation in the blast furnace product

Fig. 1 represents an excellent type of cheap hot blast iron for general purposes, which can be purchased for about 50s. per ton. The samples A are from representative pig-irons made by Messrs. The Bestwood Coal & Iron Company, Limited, near Nottingham ("Bestwood brand").

Fig. 2 is deduced from a hot blast iron, also useful for general purposes, and is in much request; it can be purchased for about 60s. per ton. Messrs. The Stafford Coal & Iron Company, Limited, Great Fenton, Stoke-on-Trent, make an iron closely conforming to this "characteristic" ("Fenton brand").

Fig. 2A is typical of an excellent hot blast pig-iron made by Messrs. The Glengarnock Iron & Steel Company, Limited, Ardeer Ironworks, Stevenston, This iron can be purchased for about 65s. per ton ("Glengarnock brand").

Fig. 3 is characteristic of the high-class hot blast iron produced by Messrs. The Lilleshall Company, Limited, Priors Lee Hall, Shifnal. This class of iron costs about 70s. per ton, and has excellent qualities for foundry work ("Lilleshall hot blast brand").

Fig. 4 is typical of a good hot blast hematite iron, and the author is indebted to Messrs. Gimson & Company, Limited, engineers, Leicester, who use considerable quantities of this class of pig-iron for the sample.

Fig. 5 represents a special foundry iron manufactured by Messrs. Warner & Company, Limited, Cargo Fleet, Middlesbrough-on-Tees. A special chilling variety is included, fairly well known among engineers; its cost is about 95s. per ton ("Warner C.B.R. brand").

Fig. 6 is characteristic of the excellent variety of cold blast iron produced by Messrs. The Lilleshall Company, Limited, Priors Lee Hall, Shifnal, and costs about 105s. per ton ("Lilleshall cold blast brand").

Fig. 7 is not a "brand characteristic," but is drawn to show the variation in analysis between the samples supplied by Messrs. Kittel & Company, Fenchurch House, London, E.C.; a place can be found for these various irons in the curves already given. These irons, in common with most brands, are much used for mixing purposes in the foundry; the "brands" are:—"Tebruck" brand; "Norrfield" brand, cost, about 65s. per ton; "Bearcliffe" brand; "Frodair" brand, cost, about 80s. per ton; "C.B. Crown Frodair" brand, cost, about 100s. per ton.

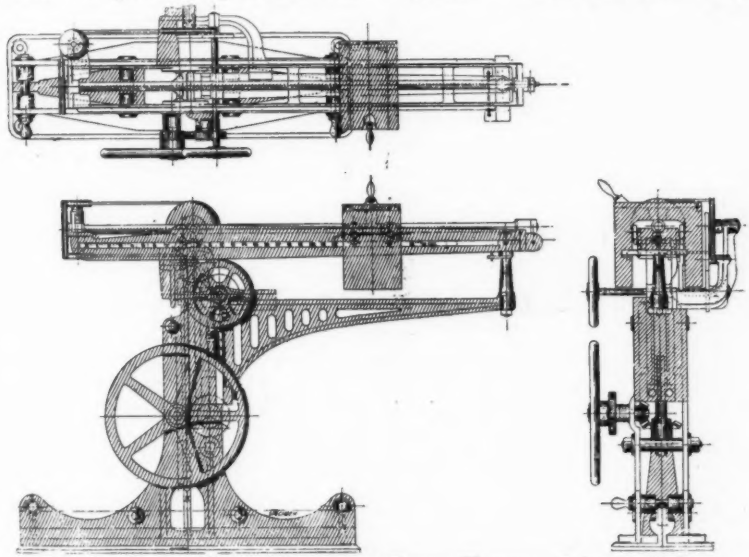

FIG. 11.—DENISON & SONS' TRANSVERSE TESTING MACHINE. CAPACITY, 40 CWT.

The careful choice of pig-iron for hardening or softening the metal is of great importance, and it is also worth pointing out that small quantities of very soft iron, say No. 1, and very hard varieties between the mottled and white, are useful for what the author calls "tempering"—that is to say, we can have a standard foundry mixture tempered by the addition of a small quantity of very soft or very hard iron, as the case may be; the chill test, which will be described later on, having revealed the necessity of

attending to this, the tempering forms a very ready means of keeping the iron mixture in its normal condition from day to day.

In addition to the pig-irons already mentioned, there are qualities designated as "cinder forge," "part-mine forge," "all-mine forge," but these need not be further dealt with here.

elements, although small in amount, must not be neglected, however.

It is hardly necessary to dwell further upon these constituents now, except to point out that by varying the elements mentioned, and by a suitable choice of pig-iron and scrap, we can produce a material of the greatest economic value in the service of mankind, and possessing

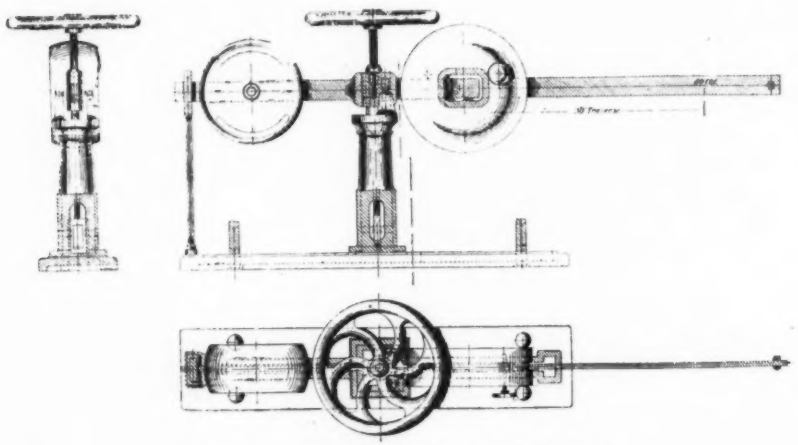

FIG. 12.—AVERY'S TRANSVERSE TESTING MACHINE.

The curves show very clearly what they are intended to convey, and the various elements are represented in the curves as follows:—Graphitic carbon = G. C., combined carbon = C. C., silicon = Si, sulphur = S., phosphorus = P., manganese = Mn. The sulphur is invariably so small that an additional diagram with an expanded scale is necessary to show more clearly its variations, and this has been done in each case immediately above the general curve for each figure. In the case of the hematite iron phosphorus has been treated in the same manner for similar reasons.

It is interesting to note the comparative uniformity of the sulphur and phosphorus in almost all the pigs of the same brand, and in some cases the manganese also; this is of special value in changing the number of the pig used in any mixture, and enables an estimate to be made of the effect of altering the percentage of the remaining elements and to select other brands, as required, possessing a different "brand characteristic." It will be seen that the most variable elements are graphitic carbon, combined carbon, and silicon, and these naturally claim first attention. The other

mechanical and physical properties which are necessary in the various arts and manufactures. The fact that the introduction of the hot blast has not removed the cold blast furnaces from our midst is conclusive proof of the economic value of this product at the present time, and at the increased cost necessarily incurred by

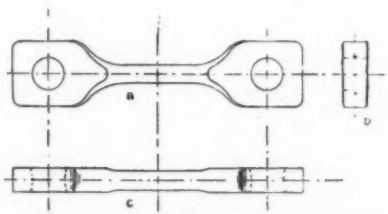

FIG. 13.—PATTERN OF TEST PIECE AS RECEIVED.

the process of manufacture. On the other hand, it is a great satisfaction to know that cheaper materials are available for much of the work that is done, and when the special qualities of strength and toughness, combined with hardness and close-

ness of grain common to the use of high-class cold blast irons, is not essential.

The study of chemical analysis must be combined with the mechanical and physical tests, and we will now proceed to consider them and their bearing upon the maintenance of good qualities of cast iron in the foundry, and the extension of its usefulness in various industries.

Fig. 8 shows such a "test specimen" used by the author, and the dimensions are as follow :—

A = 12 in.
B = 9 in.
C = 4 in.
D = 3 in.
} For heavy work.

A = 12 in.
B = 10½ in.
C = 4½ in.
D = 3¼ in.
} For light work.

These should always be cast in a dry mould, preferably a dry sand mould, to avoid any doubt upon the possibility of chilling. Holes can be drilled in the back as shown in the sketch and to suit the "boring mill" used in the operation. It is important that the specimen be held as rigidly as possible.

Sufficient has now been said to show the necessity of systematic work in the foundry and of recording results from day to day. Fig. 9 represents a sheet drawn up for such a purpose, and the author is indebted to the directors of the company whose name it bears for permission to reproduce it in this paper. The value of such a record cannot be over-estimated. It will be seen that it is fairly complete, and is expressly drawn up for the foundry as an aid in its development.

Among other things it will be noticed that the standard transverse test bar and method of applying the load are carefully defined. This size of transverse test bar, viz., 2 in. deep by 1 in. wide by 3 ft. long between points of support, tested on edge with load at centre, is an excellent one, and is rapidly gaining ground in this country as the standard of comparison, and as instanced by the manufacture of testing machines taking this size bar and built especially for the iron foundry. The capacity is generally two tons, and most founders are beginning to realise the importance of having such a machine in their works, which enables the foreman to make his own tests as he may wish and without further loss of time. Such a machine can be obtained for a very moderate sum, and is quite capable of existing in a foundry under foundry conditions, without risk of impairing its accuracy. It is, however, preferably kept under cover in the foreman's office.

Standard Tests.

A few years ago the author was engaged in investigating the question of strength in cast irons, its bearing upon the high cutting speeds now in vogue in modern machine tools, and also its relation to specifications of strength, etc., which had to be satisfied; this interesting work was complicated, inasmuch as it involved the tool room, machine departments, testing department, while last, but not least, the foundry, arises in this connection. Touching upon the question of hardness of cast iron and the cutting speeds required or aimed at in the machine departments, the author always recommends that a standard test should be instituted for arriving at a mutual understanding on this point, a standard pattern being used for making up the test

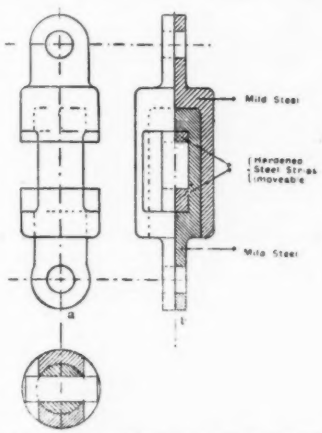

FIG. 14.—FORM OF COMPRESSION APPARATUS FOR SMALL PILLARS.

specimen which is to be subject to rigorous machine-shop tests, and the results properly recorded. Any dispute regarding the hardness of the metal can always be referred to such a machine-shop standard test. In connection with this it is necessary to have half a dozen carefully selected tools for turning, boring, and facing operations, and of the high speed class, and constructed with standard cutting angles and compared for uniformity after hardening. These should be put away as standards of reference only, from which other tools can be made for the actual cutting tests.

Such a standard test is of no mean value in determining the economic value of a cast iron for machine-shop purposes, a

point too often missed when dealing with castings of varying rigidity. Such a test isolates the "metal" from the "moulding" design.

Fig. 10 is an illustration of a foundry testing machine made by William H. Bailey & Company, Limited, Salford, Manchester. This machine has several good points; it is very simple in construction, an eye bolt is placed immediately

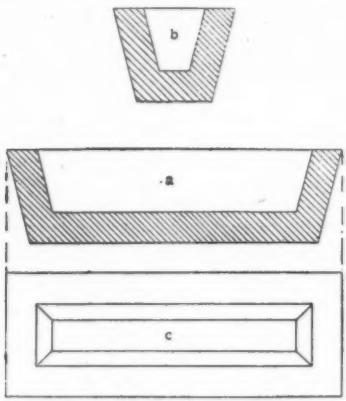

FIG. 15.—CAST IRON CHILLED MOULD.

under the machine which enables a dead-weight test to be applied to check the readings at any time, as may be desired, and arrangements are made to enable the bar under test to be placed at once accurately to the standard condition of length and central application of the load.

Fig. 11 shows a testing machine in its latest form as made by Messrs. Samuel Denison & Sons, Hunslet Foundry, Leeds. Those who are familiar with this make will recollect that loose weights were formerly in use, but these have now been dispensed with.

Fig. 12 illustrates a foundry testing machine made by Messrs. W. & T. Avery, Limited, Soho Works, Birmingham. All these machines are of 2 tons or 40 cwts. capacity, and in each arrangements are made for taking the deflection of the bars under varying loads.

In the author's opinion these machines should have their capacity increased to 50 cwt., as he has on many occasions been unable to break standard bars defined above with a 40 cwt. load. In connection with this transverse test it may be pointed out that frequent reference of such a test to tons per square inch of cross section should be discarded, as the stresses produced are peculiar to the method of testing and the form of section used.

The tensile test should also be very carefully defined under standard condition if the results are to be in any way comparable. The author is of opinion that a circular section is most satisfactory for this test.

Test Pieces.

Fig. 13 is a good pattern of test piece as received from the foundry. It is designed to get a longitudinal pull free from bending moment, and the holes are cambered with this object in view. To ensure alignment of core holes with the longitudinal axis, they must be tested on a jig after casting. The cheap form of such a test piece goes far to encourage its use, while the results obtained are very uniform and satisfactory. This particular test has a diameter of .564 in., giving a sectional area of .25 square inch. It is intended for foundry purposes, and is broken as received from the foundry without being machined. Simple multiplication by four of the actual breaking load gives the required tensile strength per square inch of the specimen.

Fig. 14 shows a form of compression apparatus used by the author for small pillars, for use in machines ordinarily made for tensile tests. It will be seen that the design guarantees an axial thrust on the test specimens at all times, side play in the end pieces being prevented.

A cast-iron chill mould is shown in Fig. 15, a form used by the author for obtaining a little definite knowledge of the nature of the fluid iron waiting to be

FIG. 16.—CARBON TUBE USED IN CONJUNCTION WITH THERMOMETER.

poured into the mould and before pouring.

This test is of great value in judging the relative hardness and other qualities of the metal used from day to day. Abnormal conditions of melting are readily detected also. Interesting chills are sometimes obtained, showing gases apparently liberated within the mass. The dimensions of the chill must necessarily be kept standard for comparative purposes, the sizes chosen being as follows: The interior dimensions of the mould are 9 in. by 2 in. at surface, and 8 in. by 1 in. at bottom of mould, by 2 in. deep, the sides of the mould being 1 in. thick throughout.

The question of temperatures and cooling curves determined in the ladle or a special mould is important, but tests are complicated by the corrosive action of the metal and slags upon the delicate thermo-metric apparatus. To overcome this, the author has suggested to Professor Callendar the use of tubes, such as shown in Fig. 16 in conjunction with his thermometers, the thermometer being inserted into the interior, and thus kept out of direct contact with corrosive slags and irons. These tubes are made of a very compact form of carbon, such as is used for arc lamp carbons, and oxidised very slowly.

It may be of interest here to note that the higher class and more costly irons are very uniform in their superior strength. Selection can also accomplish much. The author has raised a mixture from a tensile strength of 12 tons per square inch to 18 tons per square inch, by carefully selecting the pigs already in use, and without changing the total pig-iron used per charge, by careful attention to detail in working the furnaces, the formation of proper slags, etc., and the daily check made possible by the use of sheets, such as are represented by Fig. 9.

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TRADE TALK.

C. JORDAN & COMPANY'S ironfounding business at Newport, Mon., is being offered for sale as a going concern.

MR. J. W. KNOWLES has severed his connection with Messrs. J. W. Knowles & Company, ironfounders, of Bradford.

WILLIAM MORRIS & SON, metal rollers, Freeth Street, Birmingham, have been registered as a limited liability company.

SINCLAIR IRON COMPANY, LIMITED, has been registered with a capital of £50,000. The registered office is 62, London Wall, E.C.

MESSRS. H. P. MARSHALL & COMPANY have removed from Basinghall Street, Leeds, to 6 and 7, Cross Fountaine Street, Leeds.

THE ISCA FOUNDRY AND ENGINEERING WORKS at Newport was recently the scene of a fire, but no damage of consequence was done.

R. STEPHENSON & COMPANY, LIMITED, Hebburn-on-Tyne, have appointed Mr. G. A. Skentelbery as their dry dock representative.

MCONIE, HARVEY & COMPANY, LIMITED, Glasgow, have changed the style of their firm to the Harvey Engineering Company, Limited.

JAMES GIBB & COMPANY, LIMITED, has been registered with a capital of £30,000. The registered office is 99, Fenchurch Street, E.C.

JAMES H. TOZER & SON, LIMITED, has been registered with a capital of £20,000. The registered office is York Mansions, Westminster.

MCKENZIE & HOLLAND'S engineering works, Worcester, were recently the scene of a fire doing damage to the extent of about £1,000.

MR. J. BEST, tool manufacturer, of Bolton, Lancs., who traded under the style of Best Brothers & Roscoe, has been adjudged bankrupt.

MESSRS. J. & J. E. SENIOR, ironfounders, Bury, Lancs., notify a dissolution of partnership caused through the death of Mr. J. Senior.

THE members of the Keighley Association of Engineers were last week addressed by Mr. I. H. Wright, upon "The Manufacture and Use of Twist Drills."

MESSRS. T. A. CRAWFORD & J. W. HEDLEY, marine engineers, etc., Sunderland, trading under the style of Crawford & Sons, have dissolved partnership.

LUBY, HARRIS & CHAPMAN, LIMITED, has been registered with a capital of £2,000 to carry on the business of ironfounders at 21, Water Street, St. Paul's, Bristol.

THE GLAMORGAN FOUNDRY, LIMITED, is the title of a company with a capital of £500 registered, to take over the Glamorgan Engineering Works at Aberdare.

WILLETTS & ADSHEAD, LIMITED, of Dudley, have appointed Messrs. Baly, Brangwin & Company, 58, Holborn Viaduct, E.C., as their London representatives.

S. SMITH & SON, LIMITED, Beehive Foundry, Smethwick, have opened London offices at 145, Queen Victoria Street, E.C., under the charge of Mr. F. J. Hearn.

PATERSON, BELL & COMPANY, LIMITED, of 47, Waterloo Street, Glasgow, have been appointed agents in the Glasgow district for the Diesel Engine Company, Limited.

SAMUEL DENISON & SON'S business at the Hunslet Foundry, Leeds, has been converted into a private limited company, under the style of Samuel Denison & Son, Limited.

D. & J. TULLIS, LIMITED, of the Kilbowie Iron Works, Clydebank, Scotland, have appointed Burn & Company, Limited, of Howarth, as their sole agents in India and Burma.

NEW INVENTIONS.

List specially compiled for THE FOUNDRY TRADE JOURNAL by MR. GEORGE BARKER, Fellow of the Chartered Institute of Patent Agents, Consulting Engineer and Expert, 77, Colmore Row, BIRMINGHAM.
Telephone No. 1,300. Telegraphic Address—"PATENT, BIRMINGHAM."

23,995. A. F. PETCH. Controlling the speed of hydraulic rams, pistons, etc.

24,037. H. WORSDELL. Manufacturing chains and chain cables.

24,082. T. J. TRESIDDER. Manufacture of steel.

24,281. WERKZEUG MASCHINENFABRIK, BERNER & COMPANY. Pneumatic hammers.

24,507 and 24,823. W. H. WEBB, W. G. BRETTELL, and A. J. ADAMSON. Smelting of, or operating by air upon, iron and other metals.

24,820. G. CRAIG. Metal melting furnaces.

25,174. S. WHELDON. Apparatus for hardening and annealing cast-iron cylinders.

25,357 and 25,358. W. E. HIPKINS and C. F. BEAKBANE. Automatic weighing machines.

Applications marked * denote complete applications.

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OBITUARY.

MR. J. F. DONALD, of Johnstone, N.B., aged 60 years.

MR. SAMUEL JENNINGS, of Sunderland, aged 64 years.

MR. I. G. WILLIAMS, of the East Dock Engineering Works, Swansea.

MR. JOHN GRACE, of Messrs. Dean, Smith, & Grace, Keighley, aged 64 years.

MR. W. ASHMORE, of Ashmore, Benson, Pease & Company, Stockton, aged 78 years.

MR. A. A. RICKABY, founder of the Bloomfield Engine Works, Sunderland, aged 66 years.

MR. T. PITTAWAY, of Thomas Pittaway & Sons, wrought nail and chain manufacturers, aged 72 years.

MR. J. NASMITH, of Manchester, a former president of the Manchester Association of Engineers.

MR. R. S. PENDER, who, with the late Mr. G. R. Turner, J.P., founded the Langley Mill Ironfoundry, Langley Mill, Notts, aged 74 years.

QUERIES.

This department of the JOURNAL *undertakes the answering of queries in foundry practice and pattern making. We trust our readers will afford us assistance in answering these queries so far as possible.*

Communications should be addressed to the "Editor, THE FOUNDRY TRADE JOURNAL, 165, Strand, London, W.C.," *and must be accompanied by the correct name and address of the querist, not for publication, but as a guarantee of good faith.*

PIPE TONGS.—"A. H.," Exeter, asks:—Do you know of any pipe tongs that will not injure the pipes?

There are pipe tongs on the market for which it is claimed that by their use no injury to the pipes will result. We should advise you to write to manufacturers of this class of machinery.

* * *

CASTING ROLLS.—"Moulder" asks:—We are making some roll castings which are 16 in. diameter and from 5 to 7 ft. in length. They are made on end and have always more or less dirt spots on the upper end. Do you think rolls of this kind should be made horizontally?

Rolls may be swept horizontally or vertically. For success in this class of work experience is required. Details are so many that we suggest you should look up the literature on the subject.

* * *

ANNEALING CASTINGS.—In annealing malleable and small steel castings, our method is to pack them in iron pans with red ore. The castings are well annealed, but the ore gets burnt on or stuck to them, and is not only bad to get off, but it greatly spoils the appearance of the castings. Can you suggest any means of preventing this, and causing the ore to leave the castings readily, thereby giving them a nice clean appearance.

With regard to the above, "Ferrum" writes:—His trouble may arise from three sources, and he may find his remedy in:—1. Getting his castings well brushed with a steel brush, so as to get them free from all sand. 2. By bringing his oven up more slowly. 3. By examining the nature of his ore. The best to use is that with a greasy feeling when worked between the fingers. I think if he follows these simple directions he will find his trouble at an end.

POLISHING METALS.—"J.M.," Leeds, writes:—Please give me a receipe for polishing the bright work of an engine, such as the connecting rod and brass work?

For polishing surfaces of iron, fine emery cloth is as good as anything else. For polishing brass or copper work there are several receipes. These can be cleaned with sweet oil and tripoli, powdered bath brick, or red brick dust, rubbed on with flannel, and polished with leather. Vitriol and muriatic acid make brass and copper very bright, but they very soon tarnish, and consequently require more frequent cleaning. A solution of oxalic acid, rubbed over tarnished brass with a cotton rag, soon removes the tarnish, rendering the metal bright. The acid must be washed off with water, and the brass rubbed with whitening in powder and soft leather. When acids are employed for removing the oxide from brass, the metal must be thoroughly washed afterwards, or it will tarnish on being exposed to the air.

* * *

RAPID EXPANSION.—"E. S.," Bristol, asks:—I would like to know which metal or composition expands the quickest, and is at the same time the most durable. I want it to expand about $\frac{1}{16}$ in. in an ordinary candle flame.

The following table gives the expansion of various substances and covers most of the materials the foundry has to do with. The amount of expansion depends not only on the temperature, but also on the length of the piece used:—

Material.	Variation in length for each 10 degrees change of temperature.
Antimony	.0000603
Bismuth	.0000772
Brass—cast	.0001041
Brass—rolled	.0001054
Copper	.0001003
Cast-iron	.0000617
Wrought-iron	.0000667
Lead	.0001587
Steel	.0000353
Tin	.0001225
Zinc	.0001700

From this table you can select the material which suits your purpose best.

* * *

BURNT IRON.—"E.G.," Sheffield, writes:—We have a lot of blast pipes to use up in our cupola; they have been exposed to heat, often red-hot, for ten years or more. This iron seems to cause dirt spots in all of the castings. By melting these pipes with pig-iron should not the metal be satisfactory.

The iron in the pipes to which you refer is in all probability nothing else than burnt iron. That is, it has become little better than an oxide of iron. Its colour is of the various shades of red, such as may be noticed in burnt grates, fire-bars, etc. Iron of this description should be used sparingly along with a large proportion of high silicon pig, if used at all. Any attempt to reduce such iron without a good softener is sure to result in pasty and sluggish iron, accompanied by an extraordinary amount of slag which plays havoc with the cupola. The great amount of waste, in any case, makes the operation unsatisfactory.

* * *

GUN METAL IMPRESSIONS.—"B. & Co." write:—We have been pouring gun metal on hot iron plates, which we want to get an impression off, but find that the metal flutters and will not lie. Perhaps you can tell us how to overcome the difficulty.

"Aluminium" writes:—It is said that coating with aluminium paint the surfaces of iron moulds when used for brass castings, causes the molten metal to lie quietly in the mould.

The Frieze and Gilbert process uses an alloy of 5 per cent. of aluminium and iron for such moulds, this being claimed to secure the same desirable results without the paint. In this case the aluminium is thoroughly mixed with the iron, the metal is poured into a suitable mould, to form the mould for making the brass casting.

* * *

BRAZING STEEL.—"W. W. D.," Newcastle-on-Tyne, writes:—I wish to secure a brazing material, with which two pieces of steel may be brazed together, then polished and blued, representing one piece of steel. Can any of your readers help me?

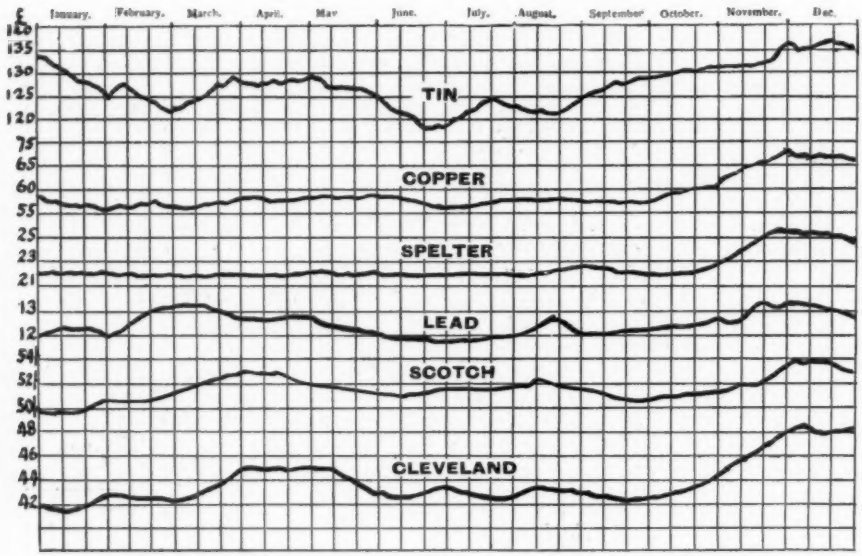
"Shop Foreman," in reply, says:—Solder for brazing steel is made as follows: Take 19 parts, by weight, fine silver, 1 part copper, and 2 parts brass, and melt them under a coat of charcoal dust. This solder is white in appearance, and renders seams less observable, but probably the joint will show to some extent after the steel is polished and blued; much will depend on the manipulation during the process of brazing.

———o———

MESSRS. JOHN REID & COMPANY'S premises at Whiteinch, Glasgow, were recently the scene of a fire.

MESSRS. WILLIAM HAMILTON & COMPANY'S works at Port-Glasgow, were recently the scene of a fire. Damage estimated at between £2,000 and £3,000.

CHART SHOWING THE FLUCTUATIONS OF THE METAL MARKET IN 1904



PRICES OF METALS.

The following table shows the approximate latest prices and position of stocks of metals during the past two years :—

METALS.	1904.	1903.
Iron—Scotch pig warrant ... ton	53/6	48/9
—Middlesbro' warrants ... ... ton	50/7	42/7
—W.C. M/nos Bessemer ... ... ton	57/6	54/6
—Stock, Scotch, Dec. 30, ...tons	11,804	9,280
Copper—Chili bars, GMB ... ... ton	£68 2/6—£68 3/9	£56 5—£56 17/6
—Stock, Europe & afloat... ... tons	16,044	13,851
Tin—English ingots ton	£135—£135 10	£135—£135 10
—Straits ... ton	£135—£135 2/6	£132 15-132 17/6
—Stock, Ldn. Hind and aflt ... tons	11,261	13,489
Lead—English pig ton	£12 17/6—£13	£11 7/6—£11 10
Spelter—Ord. Silesian ... ... ton	£24 15—£25	£21—£21 5
Quicksilver-(75lb.) bottle	£7 15	£8 5
Antimony—Regulus ... ... ton	£38—£40	£24 10—£25

CASTINGS.

In the Cleveland district the following are the nominal rates current for castings :—

	£ s. d.		£ s. d.
Columns (plain	6 10 0	to	7 0 0
Pipes, 1½ to 2½ in. ...	4 17 6	to	5 2 6
,, 3 to 4 in. ...	4 10 0	to	4 17 6
,, 5 to 8 in. ...	4 7 6	to	4 10 0
,, 10 to 16 in. ...	4 7 6	to	4 10 0
,, 18 to 24 in. ...	4 7 6	to	4 10 0
Chairs	3 10 0	to	3 12 6
Floor plates (open sand)	2 17 6	to	3 0 0

SCRAP.

The quotations for scrap, subject to market fluctuations, is as follows :—Engineers' heavy scrap, 50s., to 52s. 6d; ditto light scrap, 20s. to 22s. 6d.; clean scrap brass 36s.; clean scrap copper, 57s.; lead (usual draft), 11s ; tea (lead), 10s.; zinc, 18s. 3d.; hollow pewter, 100s.; black pewter, 65s. per cwt.

CORE OVENS

Everything for the Foundry.

JAMES EVANS & Co.,

FOUNDRY ENGINEERS,

BRITANNIA WORKS, MANCHESTER.

EVERY DESCRIPTION OF

STEEL WIRE BRUSHES

Made EXCLUSIVELY of ENGLISH Steel.

Write for Illustrated Catalogues to
THE NEW ANGLO-AMERICAN MACHINE BRUSH SYNDICATE,
31U, WOOL EXCHANGE, LONDON, E.C.
OR WIRE "LEMVILLE, LONDON."
TELEPHONE—
LONDON WALL
8836.

SAND MIXER.

Money to be got but he can't see it.

PATENT

MOULDING-SAND MIXING MACHINE.

Does **more and better work in one hour** than can be done by **two men in ten hours** in the ordinary way.

ADVANTAGES.

1.—Requires very small driving power.—One H.P. for 2 tons per hour.
2.—It accomplishes a great amount of work in a very short time.
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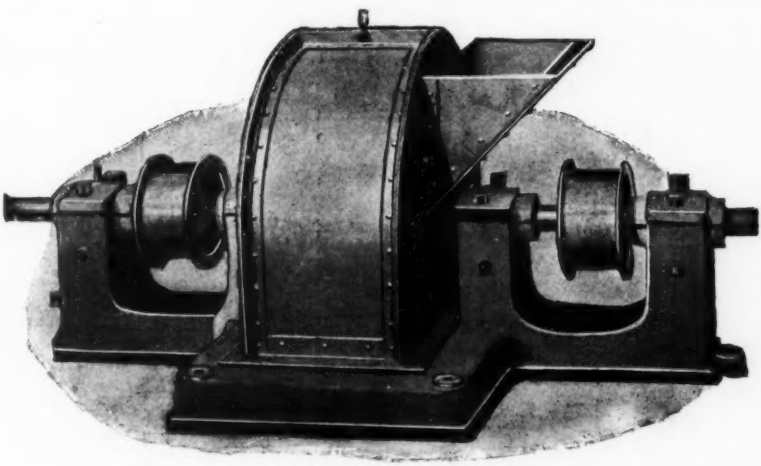

ILLUSTRATION OF NO. 1 SIZE.

This Machine has been recently improved and has a capacity of 5 tons per hour.

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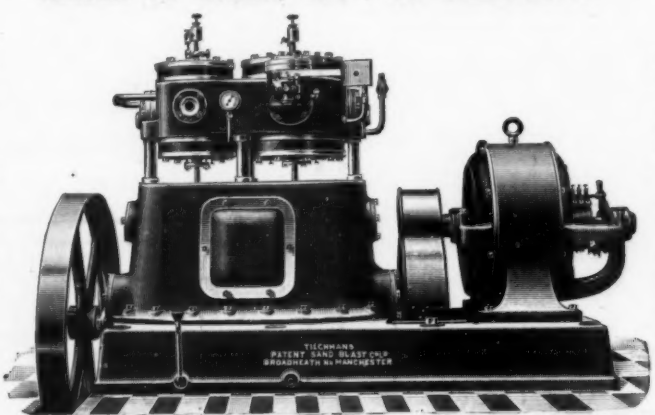

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